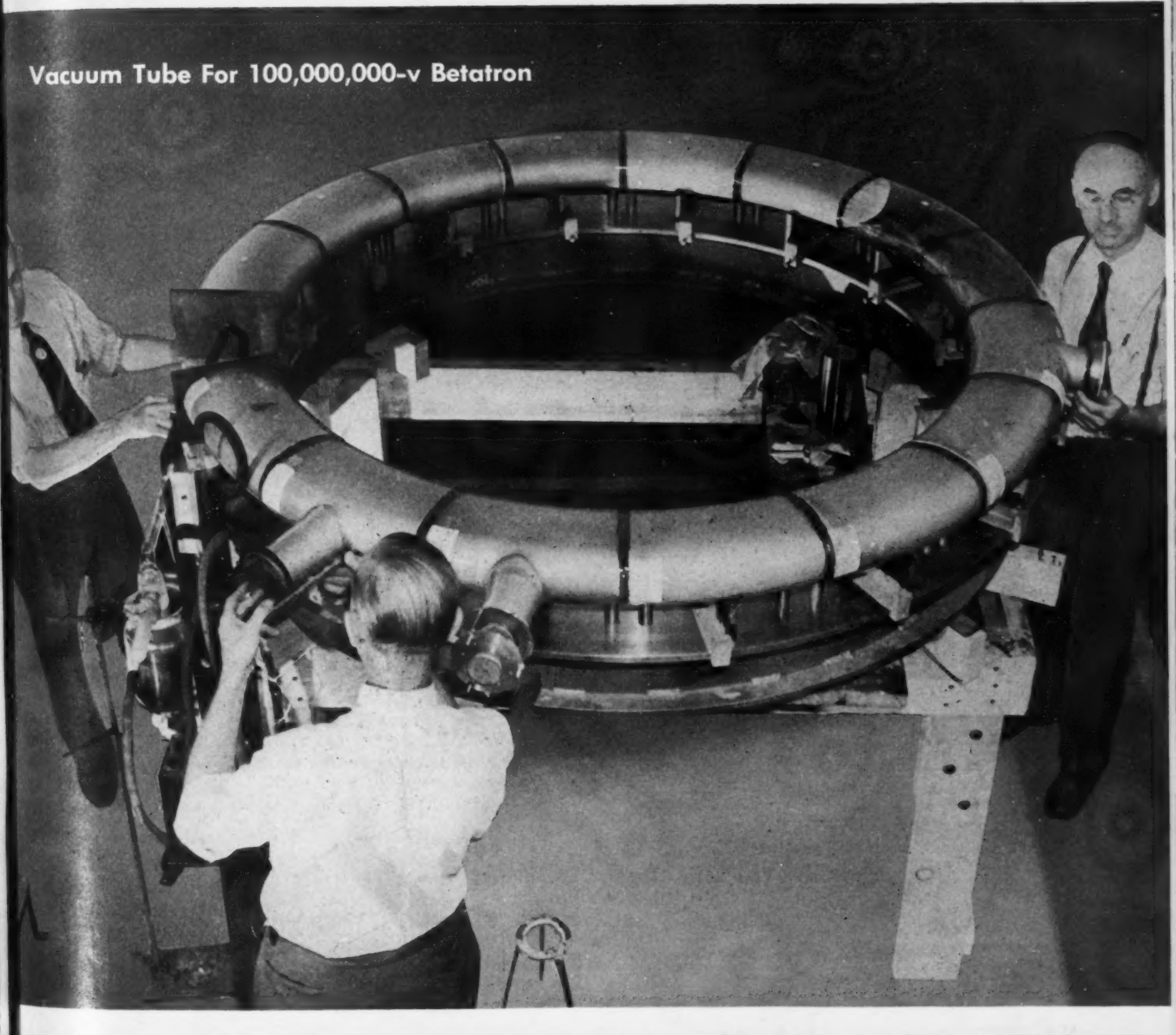
Electrical World

A McGRAW-HILL PUBLICATION



Vacuum Tube For 100,000,000-v Betatron

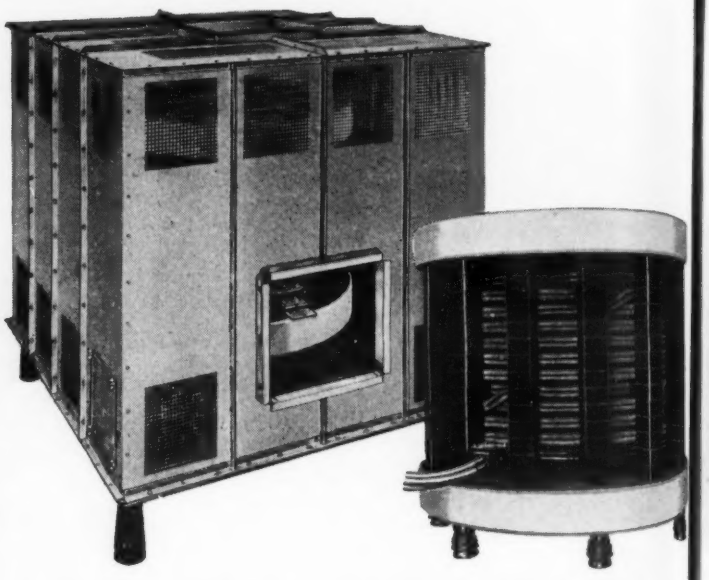
AUGUST 30, 1947

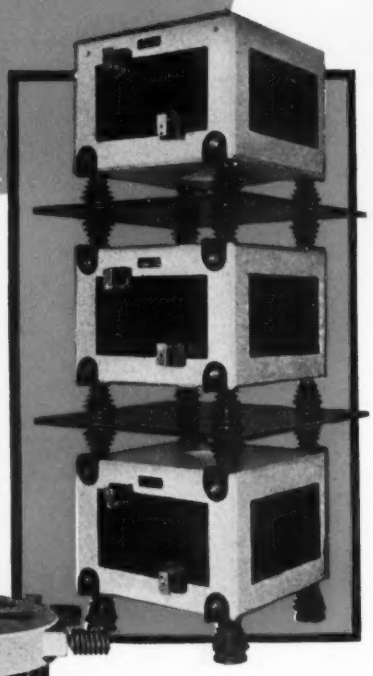
Features

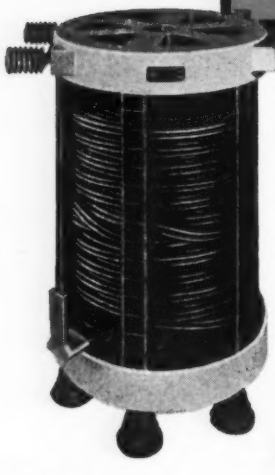
NEWS OF THE WEEK
Must Electric Rates Go Up?
Relaying Delta-Wye Transformers
Switching Capacitors With Bus Tie Breaker

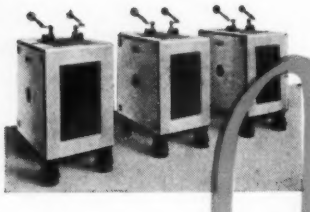
Lessen the THREAT of

powerflow INTERRUPTIONS!









THE ability of Murray Current Limiting Reactors to withstand severe short circuit conditions is a matter of record—since the first one was built in 1910. Their reliability and sturdiness have been proved—unquestionably.

Murray Reactors are "hand-tailored" to meet definite characteristics of the particular system. And if available space for their installation is limited as in crowded plants, their size is determined to suit the conditions.

Service records of Murray Low Loss Reactors disclose the clearing of the most severe short circuits, with the resultant saving of thousands of dollars in plant equipment, maintenance and operation.

Be prepared with Murray Reactors—their installations pays and pays well.

Metropolitan Device Corporation, Brooklyn, N. Y.

OTHER MURRAY DEVICES

Aerial Ladder
Cable Racks
Malleable Strapping
Meter Boxes
Meter Seals
Meter Switches
Panelboxes
Safety Switches
Testing Devices
Wiring Troughs

HIGHEST
All-Year Efficiencies

HIGHEST
Short Circuit Protection

LOWEST
Temperature Rises

Murray

—the foremost name on current-limiting

REACTORS

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 73 YEARS

LEE H. HILL.....*Editor and Publisher*

DANIEL T. BRAYMER....*Managing Editor*
ARCHER E. KNOWLTON..*Associate Editor*
FRANK R. INNES.....*Associate Editor*
RICHARD N. LARKIN.....*Associate Editor*
STANLEY A. TUCKER....*Associate Editor*
RUE M. SHOOP.....*Assistant Editor*
N. BRUCE BAGGER.....*Assistant Editor*
KENNETH K. KOST.....*News Editor*
EDNA M. GLENNON.*Assistant News Editor*
JULIUS C. MEIER.....*Western Editor*
H. S. KNOWLTON.....*New England Editor*
WALTER C. HESTON..*Pacific Coast Editor*
D. D. HOGATE....*Mgr. Washington Bureau*
W.B.WHICHARD *Washington Correspondent*

ECONOMICS DEPARTMENT....Dexter M. Keezer, *Director*. William F. Butler, Sanford S. Parker, John D. Wilson.

WORLD NEWS BUREAU . . . John Chapman, *Director*. Frederick Brewster, London; Michael Marsh, Paris; John Christie, Berlin; Robert Magidoff, Moscow; A. W. Jessup, Shanghai; Joseph VanDenburg, Bombay; Herbert Leopold, Melbourne; John Wilhelm, Buenos Aires; Russell F. Anderson, New York.

DOMESTIC NEWS BUREAUS . . . Atlanta, Chicago, Cleveland, Detroit, San Francisco, Houston and Washington. Correspondents in 43 other principal cities.

RALPH H. FLYNN.....*Assistant Publisher*

BUSINESS DEPARTMENT . . . W. W. Garey, *Manager*...DISTRICT MANAGERS... E. F. Coffey, New York; N. V. Palmer, Boston; F. P. Coyle, Philadelphia; C. R. Lippold, Cleveland; R. R. Reams, Detroit; W. H. Mencilley, Chicago; J. T. Schaefer, St. Louis.

The contents of this issue are copyrighted and may not be reproduced without the permission of the copyright owners.

August 30, 1947

Contents

Vol. 128, No. 9

This Week's Cover Picture

Injected into a 66-in. orbit diameter, doughnut-shaped, highly evacuated tube, electrons acquire added energy each revolution from a power-supply coil until they emerge as 100-million electron-volt beta rays. See page 42

News of the Electrical World..... 32

Power Supply for the 100,000,000-Volt Betatron..... 42
F. L. KAESTLE, General Electric Co

Capacitors Switched by Bus Tie Breaker..... 45
A. A. STRAUB, Southern California Edison Co

Mobile Substation Leads..... 47

Tidd Plant Electrical System Advances New Ideas—II..... 48
FREDERIC A. LANE, American Gas & Electric Service Corp

Relaying Delta-Wye Transformers..... 51
S. L. SCHEFFER, Long Island Lighting Co

Primary Network Operating Problems..... 52
A. M. MacDONALD and A. W. FUNKHOUSER, Indianapolis Power & Light Co

Must Electric Rates Go Up?..... 54
LESTER S. READY, Consulting Engineer

Automatic Sectionalizing Applied to 4-Kv..... 55
H. C. DENISON, Oklahoma Gas & Electric Co

Planned Lighting Results from Cooperation..... 56
DAVE CHITTOCK, Cleveland Electric Illuminating Co

Editorials .....31 and 40

Washington Comment..... 41

HOW 58

Engineering Reference Sheets.....63 and 66

Load Building 74

New Equipment 78

News About People..... 92

Manufacturers and Markets..... 96

Letters to the Editor..... 101

Book Reviews 102

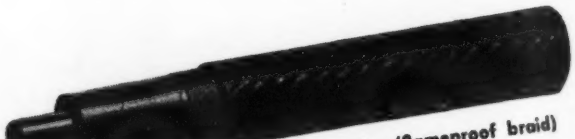
Index of Advertisements..... 110

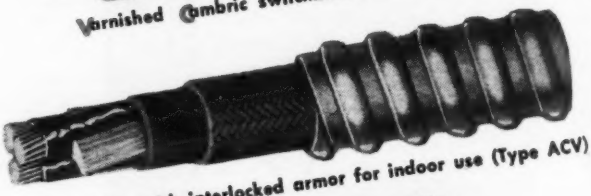
ELECTRICAL WORLD. Published weekly by McGraw-Hill Publishing Company, Inc. Publication Office, 99-129 North Broadway, Albany 1, N. Y. RETURN POSTAGE GUARANTEED. Editorial and Executive Offices, 330 West 42nd St., New York 18, N. Y. Allow at least ten days for change of address. All communications about subscriptions should be addressed to J. E. Blackburn, Jr., Director of Circulation. James H. McGraw, Founder and Honorary Chairman; James H. McGraw, Jr., President; Curtis W. McGraw, Senior Vice-President and Treasurer; Joseph A. Gerardi, Secretary; Nelson Bond, Director of Advertising; Eugene Duffield, Editorial Assistant to the President. J. E. Blackburn, Jr., Director of Circulation. Subscription rates: Single copy 35 cents. In the United States, $6 a year, $9 for two years, $12 for three years. Canada, $7 for one year, $11 for two years, $14 for three years. (Canadian money at par.) Pan-American countries, $15 for one year, $25 for two years, $30 for three years. All other countries $20 for one year, $30 for two years, $40 for three years. Please indicate position and company connection on all subscription orders. Entered as second-class matter, November 16, 1936, at the Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U.S.A. Copyright 1947, by McGraw-Hill Publishing Company, Inc. All Rights Reserved. Cable address MCGRAWHILL, New York. Branch Offices: 520 North Michigan Avenue, Chicago 11, Ill.; 68 Post Street, San Francisco 4; Aldwych House, Aldwych, London, W. C. 2; Atlanta, Ga.; Boston, Cleveland, Detroit, Los Angeles, Philadelphia, Pittsburgh, St. Louis, Washington. Member A.B.P. Member A.B.C.

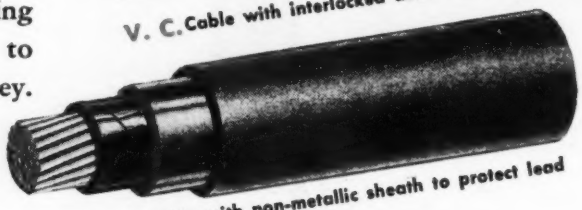
SHORT FACTS ABOUT LONG-LIVED CABLE

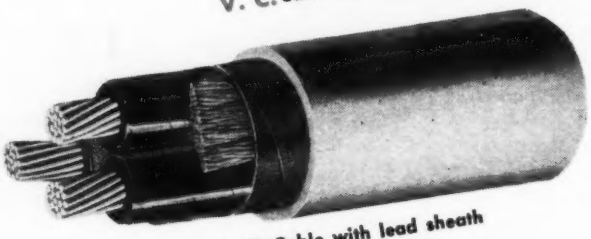
OKONITE VARNISHED CAMBRIC CABLES

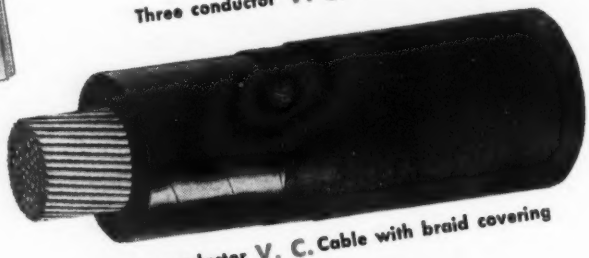
- They can carry a heavier current than rubber insulated wire.
- They are easy to splice and handle.
- They are available in all sizes and for use up to 28,000 volts.
- Bulletin OK-1013 tells the complete story of Okonite varnished cambric insulated wires and cables with illustrations, tables, and current carrying capacities. For a copy, write (using your own business letterhead, please) to The Okonite Company, Passaic, New Jersey.

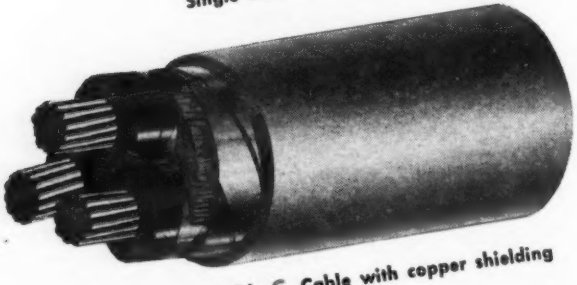

Varnished cambric switchboard wire (flameproof braid)


V. C. Cable with interlocked armor for indoor use (Type ACV)


V. C. Cable with non-metallic sheath to protect lead


Three conductor V. C. Cable with lead sheath


Single conductor V. C. Cable with braid covering


Three conductor V. C. Cable with copper shielding

OKONITE insulated wires and cables

Electrical World

AUGUST 30, 1947

Tension Over TVA

SOME MONTHS AGO, a disinterested federal agency recommended substantial changes in the Tennessee Valley Authority Act. The report was surprising for several reasons—its source, its content, and its reversal of the TVA trend. For years, TVA had never been seriously questioned within government. Successful amendments to its basic law gave it ever-greater autonomy. Proposed restrictions upon it were howled down, buried in committee. The TVA trend was up. It faltered only in implanting itself in other regions of the United States.

Last spring's TVA audit report was made by a subdivision of the General Accounting Office. Recently, there has been published in ELECTRICAL WORLD, (August 16, page 54) a refinement of the earlier report. The two documents are substantially the same.

GAO's own recommendations are as significant as those its Corporation Audits Division made last spring. For one thing, they repeat the endorsement of the general principle that TVA should be brought more closely under the control of Congress. This principle will stand many endorsements. As has been noted, it is directly in violation of the whole, long TVA trend. So sacred has TVA been in Washington —and elsewhere—that any modification not endorsed by TVA itself faces fierce opposition.

As Congress left Washington last month, the question was before two Senate committees. At least one will take up the problem early next year. It is entirely possible that the matter could come to a vote next year.

This hardly seems likely for obvious reasons. Next year is a presidential year. The Republican party scents its first real chance to win since 1928. The proposed changes in the TVA Act will be difficult to sell in the hurly-burly of a Presidential campaign. But they will be easy to attack.

The same uninquiring brand of nonsense which commanded so much space during the recent hearings on the Miller bills would blossom even more profusely over TVA. For the GOP to push revision of the TVA Act, even as recommended by GAO, would be to give the Democrats an easy issue. The GOP will work hard not to give any such issues next year.

Whatever its fate next year, the TVA reform proposal is momentous. If enacted, it would require TVA to meet certain elements of cost it has never met. Thus, it would take the first step toward a long-cherished goal of private power—cost equality between types of ownership. It will remain deficient so long as it fails to require that TVA at least *show* tax costs comparable to those of private ownership. But the GAO recommendations are a start toward equality.

★ ★ NEWS OF THE

Industry May Be Involved in Taft-Hartley Court Test

IBEW Decision to Abide by Labor Act Threatened by NLRB Counsel's Ruling—Result Could Be Quick Litigation on Constitutionality of Provision Requiring Anti-Red Oaths

THE ELECTRIC POWER INDUSTRY may shortly be involved in a test of the constitutionality of the Taft-Hartley Act.

If the test arises, it will stem from last week's interpretation of the Taft-Hartley provision requiring union officers to file affidavits of non-Communism. General Counsel Robert N. Denham ruled last week that the act requires officers of all parent organizations of a union to file the non-Communist affidavits before a union may use the facilities of NLRB.

Thus, under Denham's rule, all top officers of the American Federation of Labor or the Congress of Industrial Organizations would have to file such statements before an affiliated union—the International Brotherhood of Electrical Workers, AFL, or the Utility Workers Union of America, CIO, for instance—could use NLRB facilities in handling labor contracts and disputes.

The prospects for a quick test of the constitutionality of this part of the Taft-Hartley Act arise also from last week's decision by IBEW to abide by the terms of the act and file the necessary registration statements, including the non-Communist affidavits. If top officials of the AFL, IBEW's parent, refused to sign and submit such non-Communist declarations, IBEW would be blocked from using the facilities of NLRB under the Denham rule. Last week's action by IBEW officials, deciding to abide by the Taft-Hartley act, essentially would be nullified—and by actions beyond any IBEW control.

At that point, IBEW could forget the policy it developed last week, or it could go into court testing the validity of that section of the Taft-Hartley Act which requires a non-Communist declaration from union officials. There is no indication as yet whether IBEW would go to court. But it is widely believed in organized labor circles that this section, at least, of the Taft-Hartley Act is unconstitutional. Also, organized labor for two months has been spoiling for a fast court test of the act. Numerous labor leaders and organizations have taken many specific steps in apparent violation of the law. All of them were aimed at quick court tests. On this basis, the possibility is real that IBEW might hurry into court if its policy of abiding by Taft-Hartley is nullified because of the non-Communist interpretation which Denham issued last week.

IBEW officials reiterated to ELECTRICAL WORLD this week their decision of August 19 to file the necessary statements under Taft-Hartley "as fast as we can." It goes without saying, of course, that IBEW is fully aware of the implications of the Denham ruling.

Meanwhile, the Utility Workers Union, CIO, maintained silence on its position. This union, which has wide representation in the electric utility field, and whose constitution bars Communists from membership, inevitably will encounter the same dilemma which now faces IBEW if it (UWU) decides to abide by Taft-Hartley as the IBEW did. The AFL, at mid-week, had not formally declared a refusal to sign the non-Communist affidavits. It was widely believed, however, that at least some of its officials would refuse. But the CIO has publicly declared its intention of boycotting Taft-Hartley. Thus, if UWU were to follow IBEW in deciding to abide by Taft-Hartley, its decision would immediately be nullified by this CIO boycott and the Denham interpretation.

ELECTRICAL WORLD learned this week, entirely without official confirmation, that considerable sentiment exists within the UWU to abide by Taft-Hartley. UWU, it was learned, plans a board meeting "early in September" to decide the union's course in the matter. It also was learned, again without official confirmation, that the decision probably will be against abiding by Taft-Hartley, primarily because of the CIO position.

[*William J. Pachler, secretary-treasurer of the Utility Workers Union of America, CIO, informed* ELECTRICAL WORLD *late this week that in all probability the UWU will file at the most opportune time. This is contrary to the impression other officials of the union gave* ELECTRICAL WORLD *when the accompanying story was written.* —*EDITOR*]

The electric power industry's stake in this situation is apparent and painful. In deciding to abide by Taft-Hartley, IBEW announced that it would continue to write no-strike clauses into its contracts provided the contracts also made voluntary conciliation and arbitration "the exclusive means" of settling labor disputes. Because of the financial responsibility provisions of Taft-Hartley, this no-strike policy is intimately tied to any decision on abiding by the Taft-Hartley Act and continuing to use facilities of NLRB. If IBEW and UWU be balked from using NLRB, no-strike clauses in utility contracts would be an almost certain casualty. Then utilities undoubtedly would face the same demands for exemption from responsibility for work stoppages which have already been made upon employers in the automobile industry. An entire new and uncharted problem of labor relations would face the power industry. All the possibilities of strikes which go along with bitter negotiations of new issues also would face the industry if no-strike clauses were dropped.

4,952,876,000 Kwhr

It is only August but last week more electricity was produced in the United States than in any other week in the nation's history. See the story and output chart on Page 39.

SUPERIORITY OF THE UNITED STATES in the field of atomic energy has increased, members of the Atomic Energy Commission reported last week after a three-day conference with University of California scientists. However, it will take a lot of hard work to maintain that superiority. From left to right, Dr Ernest O. Lawrence, University of California physicist; Lewis L. Strauss, Robert F. Bacher, David Lilienthal, Sumner T. Pike, and William W. Waymack, AEC members

New Atomic Pile May Solve Key Problems in Generation

AN IMPORTANT STEP toward the solution of several key problems in the generation of the useful nuclear power has been revealed by the Atomic Energy Commission.

AEC disclosed this week the existence of a radically new type of atomic pile, operating successfully at Los Alamos, N. M., since last November.

The new pile is essentially an atomic bomb in which the chain reaction is controlled. So far it has been run at a rate of only a few hundred watts, but the power level at which it can be operated, of course, is limited only by the rate at which heat can be carried away.

The pile is the first to use plutonium instead of uranium as its fuel. It is the first to employ fast neutrons rather than slow. It is the first to operate without a moderator.

The primitive piles built during the war operated on natural uranium containing only a tiny percentage of the fissionable U-235 isotope. In consequence, they just barely run. So many neutrons are absorbed in the non-fissionable uranium that there are hardly enough left to keep the reaction running. It is necessary to slow the neutrons to their most efficient speed by a carbon or heavy-water moderator. And few are left over for production of isotopes or manufacture of additional fissionable material. The pile requires hundreds of tons of uranium and moderator.

By contrast, the new pile, consuming almost pure plutonium, requires only a comparatively few pounds of material (according to Werner Heisenberg, the German physicist, critical mass is in the neighborhood of 30 pounds). And, because there are few non-fissionable materials to absorb the fast neutrons, the "flux density" is high—that is, there are plenty of spare neutrons.

Presumably the new pile was installed at Los Alamos, the bomb center, primarily for investigation of bomb physics. It permits study of the fast-neutron chain reaction used in the bomb. But atomic experts have long been convinced that piles of this type would be needed for convenient and economic production of power.

AEC's announcement was the first encouraging news in the field of atomic-electric power made public in months. AEC has been becoming more and more of a weapon-development agency.

Columbia Basin Committee Will Study Fish Problems

Governors of Columbia River Basin states have been requested to name a representative for a standing Columbia Basin inter-agency subcommittee to study the Columbia River fish problem as it affects other resource development.

The subcommittee was proposed following a public hearing in Walla Walla on Department of Interior recommendations calling for possible postponement of construction of main stream dams, except McNary, until 1958, on the Columbia River below the Okanogan River and on the Snake below the Salmon River. This delay would permit the Fish and Wildlife Service to complete a proposed ten-year program for downstream salmon development.

The department stated it is not opposed to lower Snake River development nor does it seek the slowing-down or abandonment of this development. It proposes instead immediate investigation, planning and authorization of upstream developments for the providing of equivalent power. Those projects which have already been authorized by Congress should at least be maintained on the schedule outlined in the BPA power program. Unless the additional upstream projects should be authorized or reach a stage of development equivalent to that of the lower Snake River projects, no postponement is advocated.

Data on REA Loans for Fiscal 1947

States	Loans Approved During Fiscal '47	Miles of Line Financed During Fiscal '47	Consumers to be Connected From FY '47 Funds	Applications Backlog as of June 30	Farms Still Lacking Service Jan. 1, '47
U. S.	$251,349,172	136,277	396,376	$278,252,700	2,494,563
Ala.	7,336,000	2,762	9,280	4,985,000	129,236
Ariz.	2,384,786	948	1,897	1,225,000	2,439
Ark.	6,131,000	4,781	15,130	6,785,770	130,211
Calif.	550,072	194	374	300,000	14,881
Colo.	4,015,000	1,730	2,512	4,962,000	17,632
Conn.	.....	.....	.....	.....	990
Dela.	751,000	362	2,678	.....	2,844
Fla.	4,222,000	2,643	7,300	6,150,000	28,770
Ga.	9,811,928	6,119	25,173	12,854,000	122,366
Idaho	1,093,000	546	1,287	1,560,000	5,854
Illinois	7,061,000	3,764	12,287	8,451,500	62,310
Ind.	4,196,000	2,557	10,911	5,015,000	33,113
Iowa	13,835,000	4,700	11,172	21,552,000	45,656
Kans.	12,217,500	7,524	12,684	8,745,000	86,961
Ky.	10,718,000	6,218	22,923	10,053,250	143,930
La.	3,652,000	1,885	10,315	2,160,000	74,362
Maine	186,000	53	354	221,000	12,019
Md.	533,000	157	1,066	687,000	11,279
Mass.	.....	.....	.....	.....	2,360
Mich.	3,373,000	1,464	7,123	4,080,000	17,159
Minn.	14,792,000	8,185	16,872	9,051,330	78,152
Miss.	9,669,000	5,942	27,193	6,595,000	188,481
Mo.	14,723,500	8,252	25,530	22,464,000	134,148
Mont.	3,989,000	2,289	2,363	7,337,000	23,448
Nebr.	11,262,600	7,140	14,579	14,563,000	71,378
Nev.	.....	.....	.....	375,000	1,591
N. H.	395,000	176	870	513,000	2,181
N. J.	20,000	.....	.....	87,000	1,375
N. M.	2,869,500	1,697	2,918	2,695,000	19,077
N. Y.	95,000	40	174	228,000	11,504
N. C.	7,138,800	2,906	14,992	3,310,000	146,175
N. Dak.	9,256,000	3,344	4,110	18,894,300	60,069
Ohio	2,456,000	965	4,236	5,120,000	29,385
Okla.	8,992,000	5,800	14,824	9,866,000	94,656
Oregon	1,970,000	376	302	1,430,000	10,323
Penna.	1,434,000	876	3,511	5,788,000	30,217
R. I.	.....	.....	.....	.....	295
S. C.	4,565,000	2,842	8,406	4,630,000	79,598
S. Dak.	8,394,000	5,316	12,202	16,500,300	57,839
Tenn.	9,717,000	5,789	23,959	8,856,750	146,944
Texas	22,199,000	17,823	43,568	23,957,000	172,469
Utah	480,000	235	403	325,000	5,450
Vt.	879,000	257	257	485,000	2,782
Va.	6,470,886	2,696	9,037	2,764,000	88,197
Wash.	2,703,000	1,002	2,463	3,202,000	5,217
W. Va.	150,000	23	350	.....	49,269
Wisc.	11,368,000	2,452	6,472	6,767,500	33,380
Wyo.	2,227,600	1,298	1,460	2,662,000	6,591
Alaska	1,067,000	168	962	.....	(1)

(1) Not estimated.

EEI Distributing Manual on Farm Electrification

Edison Electric Institute has announced that it is distributing its "Farm Electrification Manual" to purchasers. The manual, the most comprehensive of its kind, is designed to serve as a technical handbook for all engaged in farm electrification work.

The manual is prepared in section form, with each section covering a major farm use of electricity. A committee of 25 farm electrification specialists reviewed each section and made suggestions that were incorporated. Seven sections are now ready, and another seven will be available shortly.

Sections available are: "Rural Representative and His Job," "History of Farm Electrification," "Farm Power," "Farm Lighting," "Mow Curing of Hay," "Farmstead Wiring," and a directory of manufacturers of farm electrical equipment.

The manual is available at Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y. The price, including binder and 14 sections, is $5 to EEI members, $8 to others.

•

Utility Operating Revenues Advance 12% in June

Electrical operating revenues of the larger privately owned electric utilities in the United States in June, 1947, were $294,686,000, compared with $263,152,000 in June, 1946, an increase of 12.0 percent, the Federal Power Commission reports.

Revenue deductions (including operating expenses, depreciation and taxes) were $232,593,000 or 15.0 percent over those of June, 1946.

Gross income, including other utility operating income, amounted to $73,433,000, an increase of 1.4 percent for the month. Net income was up 5.5 percent to $53,460,000 compared to $50,667,000 reported for June, 1946.

Kentucky Edison Co Sells System to 2 REA Co-ops

Utility Head Claims Sale Made Necessary by Inability to Buy Materials, Co-op Competition

Stockholders of the Kentucky Edison Co, Stanton, Ky., have voted to sell their stock to two cooperatives. Inability to secure materials and inability to compete with the tax-free REA co-ops whose service areas now surround that of the privately owned utility were given as the reasons for the sale.

Kentucky Edison was organized in 1932. Since then its assets have grown to a power plant at Cane Creek with a capacity of 1,100 kva in internal combustion engines and about 150 miles of 7,200/12,500-v distribution lines. It has been serving 1,250 customers in four counties.

The plant was sold recently to the Kentucky Creosoting Co which was organized to pressure treat poles when the utility encountered difficulty in buying poles in the open market.

The lines in Powell and Menifee Counties will go to the Fleming-Mason Rural Electric Cooperative Corp, Flemingsburg. The Licking Valley Rural Electric Cooperative Corp, West Liberty, will take over the lines in Wolfe and Morgan Counties.

Sale price of the common stock of the utility is to be $200,000. The sale is yet to be approved by the Kentucky Public Service Commission.

In notifying ELECTRICAL WORLD of the sale, President Harry Peet, Jr. pointed out that "our conflict is not with these local co-ops but with the general 'Government in Business' on a national basis." He also pointed with pride to the fact that in the 15 years of operation service has been interrupted less than eight hours.

Kentucky Creosoting will continue to serve the co-ops with power. It will also continue to operate the creosoting plant at Stanton.

•

Starts Consulting Firm

Edgar C. Metcalf, operations engineer for R. W. Beck & Associates, Columbus, Neb., has been made an associate of the firm. He will conduct concurrently his own practice as consulting engineer. His office will be in the Columbia Bank Building, Wenatchee, Wash. He will specialize in operations of power plants and industrial machinery including diesel engines, turbines, boilers, generators, substations, and pumping equipment. Metcalf is an electrical engineering graduate of Bucknell University and has had industrial experience.

BPA Surplus Power Will Aid in Canadian Shortage

British Columbia Electric Will Get Energy Nights and During Weekends—U. S. to Gain Later

Surplus off-peak power from Grand Coulee and Bonneville dams is now available for relief of a British Columbia shortage. A hook-up has been made between Bonneville Power Administration lines and those of British Columbia Electric Railway Co at Blaine, Wash., on the American-Canadian border.

Under terms of an exchange agreement, power produced at Grand Coulee and Bonneville, which otherwise would flow unused during nights and weekends, will be transmitted over a 230-kv line which ties together the American and Canadian power systems.

As a result of the arrangement it is estimated that revenue gains to the United States will approximate $1,200 a day.

Bonneville authorities assert that in terms of power reserves the position of the Pacific Northwest will be strengthened by the tie. Utilities of the Northwestern states will now be able to draw on the Canadian system when it has surpluses.

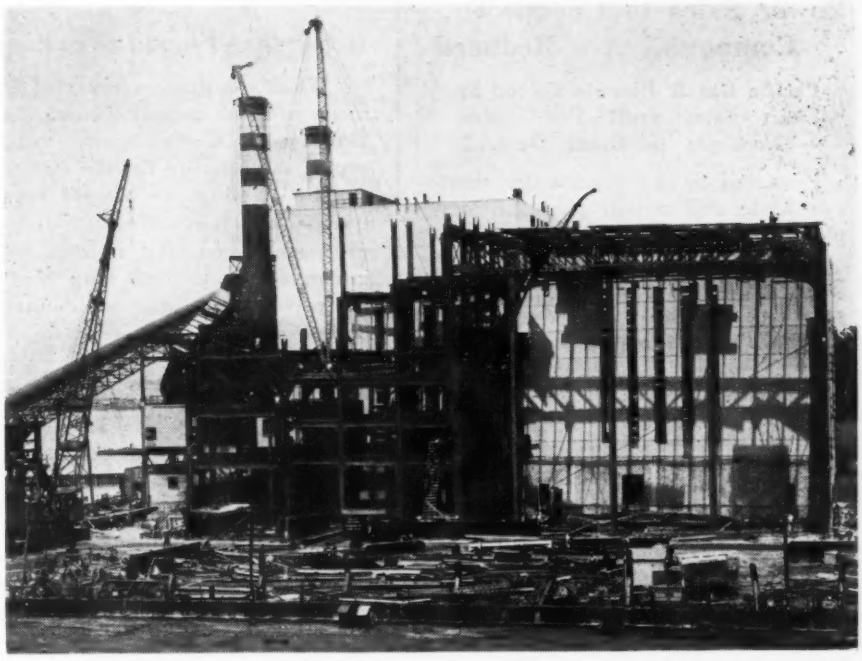
Only excess energy available over and above amounts necessary to supply all requests from Bonneville customers will be made available. This restriction is provided in the language of the Presidential permit under which the international connection was authorized in 1945. The War Department, State Department, War Production Board, and Federal Power Commission recommended the tie-line.

Canadian Utility Will Save Water

Use of Bonneville power during nights and weekends will enable the Canadian company to store water in its reservoirs during those periods, thus increasing its power resources.

For the present, power will be fed into the Canadian system through lines of Seattle Light, which will transfer the power from the Bonneville system at Seattle to Arlington, Wash. Ultimately the Arlington-Bellingham-Blaine line will receive power direct from the Bonneville system at Snohomish, Wash. This is the terminus of the high-voltage lines now under construction from Grand Coulee dam to provide additional power for the Puget Sound area.

When the 500,000-kw Bridge River plant of the Canadian company is completed, Northwest utilities will be able to take surplus power from the Canadian plant as long as it is available.



STRUCTURAL STEEL being erected at the south end of the Riverside plant of Consolidated Gas, Electric Light & Power Co of Baltimore. A third 60,000-kw unit is to be installed in time to go on the line in the middle of 1948

Foes of Skagit PUD Deal Oppose Court Rehearing

Contention of public utility district interests that a 1947 law passed by the Washington state legislature validates the proposed PUD purchase of Puget Sound Power & Light Co properties was denied by opponents of the purchase in an answer to a petition for a rehearing of the issue before the Washington Supreme Court.

The court earlier this year held the proposed $135,000,000 transaction illegal but the Skagit PUD petitioned for a rehearing (ELECTRICAL WORLD, July 15, Page 74).

Opponents of the purchase plan admitted the new law "injects an entirely new element in the case" but contended the law has no bearing on the recent decision. The PUD attorney asserted the law validated all bond issues regardless of irregularities "other than constitutional." The answer to the petition held, however, that the words "other than constitutional" excluded the proposed PUD bond issue from provisions of the act. It said the constitution would be violated if the PUD's acquire the private company's holdings.

The answer, filed by Brodie & Brodie, Olympia law firm, also argued that it was not the intention of the legislature that the 1947 act should have any bearing on the PUD case, which was then pending in the high tribunal. H. C. Brodie, senior member of the firm, said the bill was designed only to assist certain districts and towns in Yakima County, Wash.

Attorneys for the Weyerhaeuser Timber Co, which entered the original case as an intervener and appellant, supporting the stand of John Wylie, secretary of the Skagit PUD, that the deal was illegal, also asked the court to deny the petition for rehearing. They contend the 1947 law pertains only to bonds already issued and hold that the proposed PUD revenue bonds have not yet been issued.

With the answers now on file, the next move in the case, which has extended over more than a year, is for the court to hand down its ruling on the petition for rehearing. A denial will settle the issue. An affirmative ruling would reopen it for a third hearing before the State Supreme Court.

•

Burbank, Calif., Building

The Public Service Department of Burbank, Calif., has announced a five-year, $6,000,000 construction program topped by a $2,000,000 steam generating plant.

J. H. Cambridge, manager. said that this project, to be built adjacent to a present plant on Magnolia Blvd, will double the system's capacity. Burbank sells 14,000,000 kwhr monthly.

First step in the program is a 25,000,-000-gal reservoir at the mouth of McClure Canyon, now under construction. Also under way is a $2,500,000 substation.

Power Sales to Chemical Companies Are Reduced

Pacific Gas & Electric Forced to Limit Sales until Fall Rains —Chemicals in Great Demand

Pressured by a critical water shortage while still a year short of completing new facilities to give an adequate power margin, Pacific Gas & Electric Co this week was forced to cut by two-thirds power supplied to three California chemical companies under a surplus power contract.

The power cut will last for not more than three months, depending on the promptness and volume of the fall rains. Conceivably, company spokesmen said, it may end September 15. The companies were given 60 days' notice.

Dow Chemical Co, Shell Chemical Co, and Hercules Powder Co, purchasers of surplus power from PG&E at a special low rate for 15 years, use about 23,000,000 kwhr monthly, about one-tenth the needs of San Francisco.

Water Scarce, Plants Short

Company officials explained that the present cut was caused by the combination of a short water year and the fact that war-time restrictions prevented the keeping up of a construction and maintenance program that ordinarily would have kept pace with increasing demand.

The chemical companies claim that curtailment of operations at their plants will bring repercussions from a number of western industries. Also, they point out, municipalities in northern California purify water supplies with Dow chlorine.

They add that canners of peaches and olives who are volume users of caustic soda and petroleum refiners dependent on chlorine will be forced to cut production or close down if they cannot locate new sources of supply. With chemicals short all over the nation, new sources will be hard to find.

Record Demand in 1947

PG&E met a record high demand of more than 1,960,000,000 kw in August of this year, an increase of 210,000 kw over August of 1946. The agricultural load alone was up 20 percent. The utility connected more than 33,000 housing units in 1946 and 22,000 up to August 1 of this year.

No recurrence of the power crisis was anticipated for next year, the company said, since new facilities to be completed in 1948—part of a $350,000,000, six-year expansion program—will add some 380,000 hp to the system capacity.

Reporters Forget Work of Private Utilities

When newspapers reported last week that it would take nearly 20 more years to complete rural electrification, the arithmetic was correct. However, REA officials were not happy to have them use its fiscal 1947 report as authority for the statement. Reporters secured the 20-year figure by dividing the present monthly rate of co-op expansion into the number of unelectrified establishments. The rural electrification activities of business-managed utilities were forgotten. REA officials promptly announced that it will take "far less than 20 years" and conceded that the private companies are connecting "at least as many new customers" as federally financed systems.

Electric Energy Production Hits New High for June

Production of electric energy by electric utilities during June totaled 20,243,817,000 kwhr, again reaching a new high for the month, the Federal Power Commission reports. This is the tenth consecutive month in which production has set a record high over the same month in preceding years. June's production was an increase of 14.9 percent over June, 1946, but 2.6 percent below the 20,776,294,000 kwhr produced in May, 1947, which had an additional day. Combined utility and industrial production was 24,469,132,000 kwhr during June, 1947, an increase of 14.1 percent compared with June, 1946.

Production by water power in June, 1947, amounted to 6,792,877,000 kwhr or 33.6 percent of the utility total, in comparison with 37.9 percent of the total output in June of last year.

•

Tacoma and Seattle Get Firm Power from BPA

The municipally owned power systems of Tacoma and Seattle, Wash., have begun to receive firm power from Bonneville Power Administration. Tacoma is getting 40,000 kw and Seattle 15,000 kw to supplement supplies from their own generating plants, BPA Administrator Paul J. Raver has announced.

The deliveries have started under terms of contracts pending completion which replace interchange contracts executed in 1940. The contracts will provide for a reduction of one-half a mill to two mills in the rate charged for Bonneville Power. They also stipulate a continuation of the exchange of energy and the transfer of power from the government's Columbia River system to BPA customers in the Puget Sound area.

The three parties to the contracts will have mutual use of storage space in their reservoirs, when available, for any energy which would otherwise be wasted. This will provide the basis for complete pooling of resources of the three systems.

The ten-year contracts provide that the purchasers may increase or reduce the contract demand when they desire. The contracts in all respects recognize the existing arrangements between the two cities for the integrated operation of the Tacoma and Seattle municipal resources.

At the time the first interchange agreements were executed with the two municipal systems, they had sufficient generation to meet their normal requirements. However, population increases and industrial growth have increased requirements to a point beyond generation installation schedules on the Skagit and Cowlitz Rivers.

•

Rights-of-Way for Central Valley Line Being Sought

Negotiations for rights-of-way for construction of the Central Valley Project transmission line on the west side of the Sacramento River were opened following Congressional approval late in July of a $1,500,000 appropriation.

Phil Dickinson, assistant regional director of the Reclamation Bureau in Sacramento, said that it was expected available money will permit construction of about 30 miles of the line from Shasta Dam to Cottonwood. He anticipated completion of that section within six months. Additional funds will be sought to continue construction of the line, he said.

•

Co-op Gets Franchise

Washoe County (Nevada) commissioners have granted a 25-year franchise to the Plumas-Sierra Rural Electric Cooperative for extension of power lines into the Red Rock and Black Springs areas in the northern part of the county.

Shasta Dam Power Cut Off from PG&E System

Bureau of Reclamation Forced to Take Step in Order To Speed Construction of Keswick Dam

Richard L. Boke, director of Region II of the Bureau of Reclamation, announced a shut-off of 30,000 kw of overload power from Shasta dam that had been available to Pacific Gas & Electric Co for peaking purposes. He declared that power supply in the area would be on an "emergency basis" from now until January 1.

The curtailment, from September 1 to November 15, is necessary, Boke said, if construction of Keswick dam on the Sacramento River below Shasta is to continue.

Boke made a "public explanation" of the discontinuance so that the Bureau shall "not be held responsible in the event of failure of the area's power capacity to meet power requirements during the period."

He said that "such a failure has already taken place this year and may very likely occur again on a more serious scale." On July 29, he said, the supply in the area was some 40,000 kw short of demand, causing frequency of the system to drop from 60 to 59.7 cycles per second.

Overload Regular Practice

The two Shasta units, with a nameplate capacity of 150,000 kw, have been operating for months at 170,000 kw, considered the maximum constant overload for safe operation, he said. Early in July, he continued, PG&E asked that Shasta be operated at an additional 10,000 kw overload for peaking purposes over brief periods.

However, that extra 10,000 kw was called into use for longer and longer periods until by Augst 13 it was being used for "round-the-clock base load," he said.

In the September-December period, Boke said, the area will lose a minimum of 100,000 kw capacity because of reduced streamflows and cessation of irrigation releases. At the same time it will experience unprecedented peak loads.

Answering Boke's release, W. G. B. Euler, PG&E vice-president and general manager, asserted that the power supply situation had been aggravated by record demand and an unusually dry year.

"We have taken every step within our power to insure continuance of service to every user. Thus far we have succeeded except for the reduction of power service to three large surplus industrial users and certain regulation of supply to the Ames Aeronautical Laboratory at Sunnyvale." These are users of surplus power.

Euler pointed out that PG&E's current expansion program was so advanced that $250,000,000 of a projected $350,000,000 will have been spent by the end of next year. With the completion of facilities producing 400,000 kw plus 200,000-kw capacity to be added to the Bureau's Shasta plant, the area's supply will be increased by 50 percent of last year's peak.

One Use for 'Goop'

Seattle City Light will use four carloads of "goop," a highly inflammable compound developed during the war for incendiary bombs, to help destroy debris on the shores of its Ross Lake in the Cascade Mountains.

When Ross dam is finished, more than 12,000 acres of forest land will be flooded. Debris that will rise from the forest will be rounded up by motorboat and towed to shallow water. The lake will be slightly lowered, and the drying debris treated with "goop" and burned.

City Light obtained the compound, principally a mixture of gasoline jelly and aluminum powder, from WAA for shipping costs.

•

Smoke Control Ordered

The Virginia Corporation Commission has ordered the Virginia Electric & Power Co to install smoke and cinder control devices at its Alexandria plant with "all reasonable dispatch." The action followed filing of criminal warrants by the city charging the utility with violating a smoke control ordinance. The utility claims that smoke abatement equipment has been ordered but that it cannot stop the plant long enough to install it.

•

Again the Hour of Charm

Phil Spitalny's Hour of Charm, all girl orchestra and choir, will return to the air at 3:30 pm (EST), September 7, over the Columbia Broadcasting System network. The program each Sunday afternoon will again be sponsored by the leading private electric utility companies.

FPC OK's Emergency Ties in Connecticut and Texas

The Federal Power Commission has approved emergency interconnections of electric utility systems in Connecticut and Texas. The commission's action brought to five the number of emergency ties it has approved in recent months. Two other interconnections in Texas and one in the Pacific Northwest already are in operation.

Connecticut Light & Power Co was authorized to maintain its connection with the Connecticut Power Co system at New Brunswick for emergency use until December 31, 1948. The second new interconnection will link the systems of Texas Electric Service Co and Southwestern Public Service Co until November 1, 1948.

Facilities to effect the Connecticut tie are substantially in place. They were used to interconnect the utilities from 1942 until early this year. The inter-tie will be reestablished by erecting six conductors in one span of CL&P's transmission line and restoring six taps on Connecticut Power's line.

CP&L's application to FPC stated that the company required the connection to safeguard its service and that of companies with which it is now interconnected. Emergency use of the tie will not subject CL&P, which recently won a long jurisdictional battle with FPC, to its regulation.

The Texas interconnection was requested by Texas Electric Service, Dallas Power & Light Co and Texas Power & Light Co. The companies reported an emergency existed in the areas served by them. In the face of a sudden increase in demand for energy, the companies said they had been unable to secure sufficient generating equipment. A major factor in the emergency has been the demand for service by industries which previously used their own prime movers.

Southwestern Public Service is expected to supply 20,000 to 40,000 kw of reserve capacity through the interconnection to the north Texas interconnected system.

•

2 Units Shut Down

Cable failures in the Harding Street plant of the Indianapolis Power & Light Co last week led to the shutting down of two generating units. Each was down for a little over 24 hours. Interconnected utilities supplied the 75,000 kw of lost capacity. When the company explained the situation to two department stores and eight manufacturers, they voluntarily reduced their load about 10,000 kw.

SEC RULINGS

SUSQUEHANNA POWER Co has been authorized to reclassify common stock to create a $3,676,091 capital surplus, which will be used to make certain accounting adjustments. The company is a subsidiary of the Philadelphia Electric Power Co. (Release No. 7605).

ROCHESTER GAS & ELECTRIC CORP has been granted permission to sell up to $8,000,000 of unsecured promissory notes, each of which will bear interest of up to 2 percent per annum and mature within nine months of date of issue. Proceeds will be used for new construction or to liquidate outstanding notes. SEC also granted General Public Utilities Corp, parent, permission to make capital contributions to company during the next two years and nine months. (Release No. 7607).

POTOMAC ELECTRIC POWER Co's amended recapitalization plan has been approved. Under the plan the company proposes: (1) To exchange or redeem on September 1, 1947, all of its outstanding preferred stock consisting of 20,000 shares of 6 percent cumulative preferred stock, series 1925 (par $100) and 50,000 shares of 5½ percent cumulative preferred stock, series of 1927 (par $100). For this purpose Pepco will issue 140,000 shares (new preferred stock) (par $50) and will offer to holders of its presently outstanding old preferred stock the right to exchange their shares for shares of the new preferred stock on the basis of two shares of new preferred stock for one share of old, plus a cash adjustment. (2) To make a short-term bank loan to the principal amount of $7,490,000 in order to provide itself with funds to finance the redemption of its old preferred stock, pending the consummation of the sale of the new preferred stock. (3) To increase, after the proposed redemption of its old preferred stock, its authorized capital stock from $30,000,000 to $75,000,000, consisting of 400,000 shares of preferred stock (par $50) (the new preferred stock) and 5,500,000 shares of new common stock (par $10). As part of such recapitalization the presently outstanding 90,000 shares of Pepco common stock (par $100), all of which is owned by Washington Railway & Electric Co, will be reclassified into 85,000 shares of the proposed new preferred stock and 2,961,250 shares of the proposed new common stock. Washington Railway proposes: (1) To acquire the 85,000 shares of new preferred stock and the 2,961,250 shares of new common stock of Pepco upon the recapitalization of Pepco; (2) To acquire, upon the dissolution of its two subsidiaries, the Washington & Rockville Railway of Montgomery County and Great Falls Power Co, the remaining assets of Washington Rockville and Great Falls and to convey to Pepco all of the real property conveyed by Great Falls to Washington Railway. (Release No. 7608).

COMMONWEALTH & SOUTHERN CORP'S plan to transfer its interest in four southern operating utilities and in a non-utility subsidiary, to the Southern Co, a holding company organized for that purpose, was conditionally approved, and in anticipation of this approval C&S filed a new plan for ultimate dissolution, providing for distribution of certain portfolio securities in retirement of its preferred stock and distribution of its remaining assets, including shares in the Southern Co to its common stockholders. The companies to be transferred to Southern Co are Alabama Power Co, Georgia Power Co, Gulf Power Co and Mississippi Power Co, all operating subsidiaries, and Savannah River Electric Co, a non-utility subsidiary. C&S agreed to dispose of its direct or indirect interests in gas and transportation properties of Alabama Power, Georgia Power and Gulf Power and also to dispose of its interests in all subsidiaries other than the five companies and to dispose of any remaining interest in Southern as soon as possible after retirement of its preferred stock. In approving the plan, the commission concluded the electric properties of the four southern operating companies were retainable under common control as an integrated public utility system along standards of the Holding Company Act, and that the continued existence of Southern as a holding company over the retainable properties was appropriate. (Release No. 7615).

CENTRAL AND SOUTH WEST CORP has received permission to sell $4,300,000 of unsecured serial notes to the First National Bank of Chicago and the John Hancock Mutual Life Insurance Co. The notes are payable at the rate of $125,000 semi-annually from January 1, 1948, through January 1, 1959, with the final installment of $1,425,000 maturing on July 1, 1959, and bearing interest at the rate of 2, 2¼ and 3 percent yearly, depending on the maturity date. Also approved was the proposed prepayment by Central and South West of two secured notes totaling $348,000. Central Power & Light Co, a subsidiary of Central and South West, received permission to reclassify its authorized common stock from 250,000 no par value shares to 1,072,100 shares, $10 par value. Central Power will exchange its 202,180 shares of no par value common stock outstanding for 772,104 shares of the new common. Central and South West, which holds all of Central Power & Light's common shares, also received permission to purchase 299,996 shares of the new common for $2,999,960 cash, and 65,500 shares of the no par value common stock of another subsidiary, the Southwestern Gas & Electric Co, for $1,000,000 cash. (Release No. 7639).

OKLAHOMA POWER & WATER Co's proposal to sell to Oklahoma Natural Gas Co, a non-affiliate, its gas utility properties located in the counties of Osage, Tulsa and Pawnee, in the state of Oklahoma, for $850,000 subject to closing adjustments, has been approved. Oklahoma Power & Water will use the proceeds to repay $850,000 principal amount of its bank loan notes now outstanding in the aggregate principal amount of $2,775,000. (Release No. 7625).

MEETINGS

Southeastern Electric Exchange—Engineering and Operation Section, Henry Grady Hotel, Atlanta, September 25-26; Sales Conference, Biltmore Hotel, Atlanta, October 29-31. John W. Talley, executive secretary, 303 Haas-Howell Bldg, Atlanta 3, Ga.

Interstate Power Club of New York—Fall Meeting, Martinique, New York, September 29. Thomas C. Roe, secretary, Delaware Power & Light Co, Salisbury, Md.

Electrochemical Society—Fall Congress, Copley-Plaza Hotel, Boston, October 15-18. Colin G. Fink, secretary, 3000 Broadway, New York 27, N. Y.

Missouri Valley Electric Association—Accounting Conference, President Hotel, Kansas City, Mo., October 16-17; Rural Roundtable, Skirvin Hotel, Oklahoma City, Okla., October 30; Sales and Rural Conference, Skirvin Hotel, Oklahoma City, Okla., October 31-November 1. I. D. Petteqrew, director, 1004 Baltimore Ave, Kansas City 6, Mo.

Previously Listed

American Society of Mechanical Engineers—Fall Meeting, Hotel Utah, Salt Lake City, September 1-4.

Rocky Mountain Electrical League—Annual Convention, Townsend Hotel, Casper, Wyo., September 4-6.

Edison Electric Institute—Accident Prevention Committee, EEI, 420 Lexington Ave, New York, September 8-9; Meter and Service Committee, joint meeting with Meter and Service Methods Committee of the Association of Edison Illuminating Companies, Lord Baltimore Hotel, Baltimore, September 22-24; Purchasing and Stores Committee, Henry Grady Hotel, Atlanta, Ga., September 29-October 1; Prime Movers Committee, Benjamin Franklin Hotel, Philadelphia, October 6-7; Electrical Equipment Committee, Benjamin Franklin Hotel, Philadelphia, October 6-7; Transmission & Distribution Committee, Benjamin Franklin Hotel, Philadelphia, October 9-10.

National Electrical Contractors Association—Annual Meeting, Palace Hotel, San Francisco, September 8-10.

Instrument Society of America—Second Annual Conference and Exhibit, Stevens Hotel, Chicago, September 8-12.

Illuminating Engineering Society—Technical Conference, Roosevelt Hotel, New Orleans, September 15-19.

Indiana Electric Association—Annual Convention, French Lick Springs Hotel, French Lick, Ind., September 17-19.

International Association of Electrical Inspectors—Northwestern Section, Eugene Hotel, Eugene Ore., September 22-24. Southwestern Section, Mission Inn, Riverside, Calif., September 29-October 1; Western Section, Mount Royal Hotel, Montreal, Canada, October 13-15; Eastern Section, Seaside Hotel, Atlantic City, October 20122; Southern Section, George Washington Hotel, Jacksonville, Fla., October 27-29.

Association of Iron and Steel Engineers—Annual meeting, William Penn Hotel, Pittsburg, September 22-25.

Pennsylvania Electric Association—Annual meeting, Benjamin Franklin Hotel, Philadelphia, September 23-24; Transmission & Distribution Committee, Fort Ligonier Hotel, Ligonier, Pa., October 16-17; Prime Movers Committee, Benjamin Franklin Hotel, Philadelphia, October 23-24.

American Institute of Electrical Engineers—Middle Eastern District Meeting, Biltmore Hotel, Dayton, Ohio, September 23-25; Midwest General Meeting, Congress Hotel, Chicago, November 3-7.

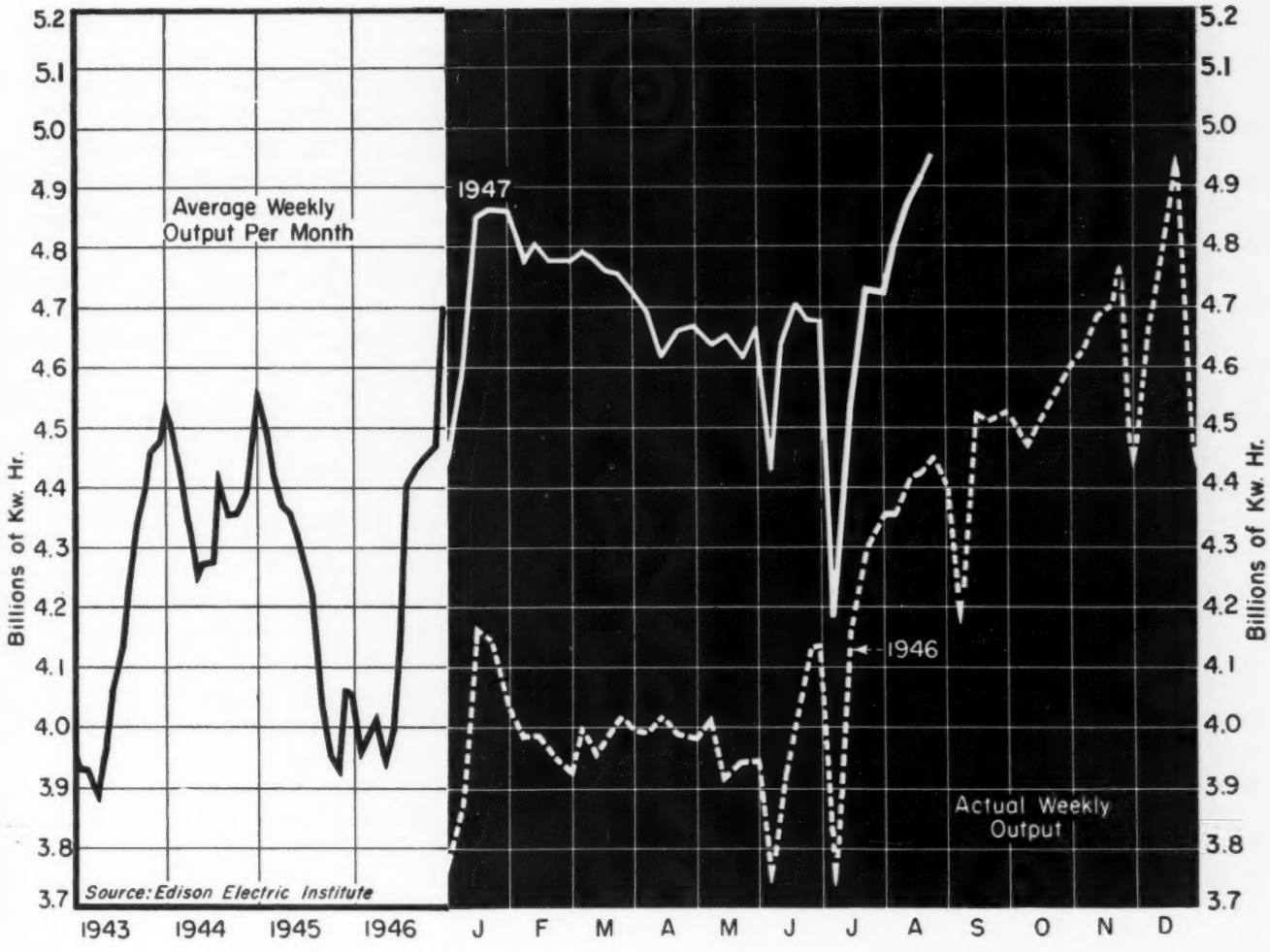
National Research Council—Conference on Electrical Insulation, Massachusetts Institute of Technology, Cambridge, Mass. September 24-27.

Fluorescent Lighting Association—First Annual Cold Cathode Fluorescent Lighting Exhibit, Commodore Hotel, New York, October 7-9.

National Farm Electrification Conference—Claypool Hotel, Indianapolis, October 7-8.

International Association of Electrical League—Annual Conference, Statler Hotel, St. Louis, October 8-11.

American Standards Association—Annual Meeting, Waldorf-Astoria Hotel, New York, October 21-23.



Penelec's 5-Year Program to Up Capacity 140,000 Kw

Pennsylvania Electric Co has announced a five-year program to increase generating capacity by 140,000 kw. Present capacity is 340,600 kw.

Figuring prominently in the plans are additions and improvements at Seward station, just north of Johnstown, Erie's Front Street station, and the completion of the 70,000-kw station in Warren. In addition there are plans for changes in several transmission lines and substations to obtain maximum efficiency from present and planned equipment.

At Seward station, Penelec's largest, a 300,000-pound-capacity coal-burning boiler will be installed to permit more efficient loading of the present generating equipment. This will give an immediate increase in capacity from 85,000 to 90,000 kw, the limit of turbine capacity. Installation of a second boiler of the same capacity will begin in 1949, and it will be ready for operation by the middle of 1950. This second boiler together with the one mentioned previously will be used to operate a 40,000-kw turbo-generator to be delivered in November, 1949.

Scheduled additions at the Front Street station include a 300,000-pound boiler and a 25,000-kw turbine which will increase capacity to 78,000 kw.

Improvements are also planned to obtain greater output at the Williamsburg station and at the hydro station at Warriors Ridge.

The Warren station, under construction since March, 1946, will have its first 35,000-kw turbine in operation by mid-summer of 1948, and the second 35,000-kw unit a year later.

•

15,000-Kw Plant Started

Central Louisiana Electric Co has started construction of a 15,000-kw steam plant on Bayou Cocodrie, about ten miles from Bunkie and 15 miles from Ville Platte. It will be named for President F. H. Coughlin.

Other News

New Equipment ..... **Page 78**
News About People **92**
Manufacturers & Markets .. **96**

Output Hits Record High

The electric output curve moved upward during the week ended August 23 to the highest point ever recorded, according to Edison Electric Institute. The amount of electrical energy distributed by the light and power companies was 4,952,876,000 kwhr, comparing with 4,923,000,000 kwhr during the preceding week. The previous high was 4,940,453,000 kwhr for the week ended December 21, 1946. During the week ended August 24, 1946, the total was 4,444,040,000 kwhr.

Weekly Output, Millions Kwhr

1947		1946		1945	
Aug. 23	4,953	Aug. 24	4,444	Aug. 25	4,116
Aug. 16	4,923	Aug. 17	4,422	Aug. 18	3,939
Aug. 9	4,874	Aug. 10	4,412	Aug. 11	4,395
Aug. 2	4,806	Aug. 3	4,351	Aug. 4	4,432
July 26	4,730	July 27	4,352	July 28	4,435
July 19	4,372	July 20	4,293	July 21	4,385
July 12	4,531	July 13	4,156	July 14	4,295
July 5	4,190	July 6	3,741	July 7	3,978
June 28	4,675	June 29	4,133	June 30	4,353
June 21	4,676	June 22	4,129	June 23	4,358

Percent Change from Previous Year

	Aug. 23	Aug. 16	Aug. 9
New England	+ 5.0	+ 4.8	+ 3.7
Mid-Atlantic	+ 8.5	+ 9.1	+ 5.8
Central Industrial	+13.5	+12.5	+11.5
West Central	+15.8	+14.4	+12.3
Southern States	+10.2	+10.2	+10.4
Rocky Mountain	+15.4	+14.1	+10.0
Pacific Coast	+12.6	+13.9	+16.1
Total United States	+11.4	+11.3	+10.5

Electrical World
OPINION

Tempest over Television

TWICE recently, ELECTRICAL WORLD has editorialized against the residential rate rider adopted by the Norwich, Conn., municipal electric department. Our July 19 statement brought a dissent from Norwich's General Manager, Theodore Braaten. Mr. Braaten's letter will be found in this issue, on page 102.

Mr. Braaten's first point is that any residential customer who buys a television set would consider the extra $1.26 monthly, which the Norwich rate imposes, a cheap fee for the entertainment the set affords. Suppose the statement were true. We feel that many, if not most, residential customers in the land would pay more for electric service than they do if the alternative were doing without it. But this feeling would not convince the nation's utility regulators that a rate boost should be allowed. On an over-all basis, utility rate making is based upon cost of service, not what the traffic will bear. Thus even if this first point were true—and with many television owners it may well be—it seems not a germane point. If all rates were based upon this idea, they would differ between all users. One would pay so much for service to one type of washing machine, for instance, and so much more for service to another.

The next objection raised is that television sets ". . . add very little compensation in the way of kwhr per kw of system demand responsibility." It adds that an average set, with supplemental lighting, will add less than 400 revenue kwhr yearly. Norwich does not like any implication that a power system should sell kilowatthours at a loss.

First, let us consider the supplemental lighting angle. The editors of *Electronics*, whose editorial we quoted July 19, assure us that supplemental lighting is not required by today's television sets. In so technical a discussion as this, we can only side with the television experts.

Now, if television with supplemental lighting would add less than 400 kwhr yearly, television without such lighting would add many less kwhr a year. Purely hypothetically, let us assume the figure would be 200 kwhr a year.

These would be, almost entirely, off-peak kwhr today. Television is available only near cities today. It is available generally in the earlier parts of the afternoon and after the evening peak. So these few kwhr which Norwich does not wish to sell at what it calculates to be a loss are not going to complicate the capacity problem.

One of the things we find it hard to see is that the kwhr which go into video reception will be sold at a loss. Again, today's television is not a peak load, whatever it may one day become. Since it is not a peak load, it can be handled by existing equipment in its off-peak incidence. Thus, it requires no extra facilities.

Since it is used off-peak, it tends to improve load factor. This the industry has been trying to do for years. Why, then, take a step which might strangle a good, future load, as a restrictive rate, applied in television's infancy, might do? A video set, actually, takes less watts today than an electric iron. Now, in the last twelve years, residential use of electricity has more than doubled. Would it have done so if a restrictive rate had been placed on electric irons, not to mention other appliances? An iron's load, also, may be more of a peak load than a video set. An iron may be used at any time—is subject only to the wish of the user. A video set may only be used when telecasting is in progress. Today, it is not often in progress on the peak.

Here, ELECTRICAL WORLD is concerned about a philosophy which is much broader than a single rate provision of any system. We believe the electric power industry's job is to sell kwhr. We feel that artificial restraints, of any kind, make it hard to do that job. When and where the job can not be done without them, we do not argue. But when they are not needed, we feel they create more problems than they are worth. An artificial restriction on energy use hurts sales. It hurts efficiency. It hurts public relations. It tends to create regulatory activity which is a distraction from the main job—of selling kwhr.

We fear the Norwich rate is an artificial restriction. Thus we oppose it.

Safeguarding Arbitration

IT IS a surprise to find an arbitrator ruling that an employer must rehire a worker discharged because of actions in support of the Communist Party line which militated against the employer's interest. This decision was handed down by James L. Fly, late of the Federal Communications Commission and TVA. The employer was the National Council of Jewish Women. The employee was an area secretary. Fly did not absolve the employee of guilt. He found and said that she "acted improperly." It was not a case involving red baiting or attempts to exert improper control upon an employee. Fly ordered reinstatement, but without seven months' back pay accrued since dismissal. His reason was that the employee had not previously been warned against the offending actions and thus had a just complaint.

Such a decision is obnoxious to those who dislike Communism. Still, responsible, even management-minded, authorities assure us that many labor contracts exist whereunder *any* fair arbitrator could only rule as Fly did, no matter how obnoxious the ruling might be. The contract involved here may or may not have been one justifying such a decision.

The situation emphasizes the necessity of precise contracts and arbitration agreements. Such precision is doubly vital to utilities. They are public service industries. There is a host of panacea-seekers which considers arbitration to be the whole and only answer to utility labor disputes. Considerable new legislation is on the statute books of the land which uses arbitration of one form or another as the device for protecting public health and safety in public service disputes.

It is only with such precision that an arbitration may be safeguarded. How else can one prevent the arbitrator's background, his political thinking, his personal philosophy from shaping a decision? It can only be done by limiting the scope, by making the contract unmistakable. To be safe, arbitration must be a judicial process. It can not safely permit the arbitrator to legislate.

Trimming Underground Costs

COST OF UNDERGROUND line construction has pretty much defied efforts to bring it into proximity with overhead lines. The incentive is great, but contributions generally have been fractional.

One of the greatest single cuts proposed in recent years is that if manhole-to-manhole distance can be more than doubled, over-all costs can be halved. How make any such phenomenal saving without changes in cable, splices, ducts and manholes? R. G. Finnerty, of Boston Edison, has explained how. There are less than half as *many* manholes for 1,000-ft pulling lengths as for 450-ft. There are less than half as *many* sections to pull. There are less than half as *many* joints to make and fireproof. Failures and maintenance would be only negligibly different. Thus annual costs probably could be halved.

This is the rough economic justification for cutting the number of manholes. The necessary parallel for the doubling of pulled-cable lengths is found in the value of friction coefficient. Without going into the details Finnerty told the New England distribution engineers, it may be said that 0.3 suffices in many cases where 0.5 has been used. The gain comes from lubrication, well-aligned ducts, careful pulling.

As soon as these estimates and proposals are confirmed in practice, one of the largest chunks ever lopped off underground construction will have been established. Previous approaches have been largely nibbles, so much so that buried cable loomed up very frequently in discussions—if not in installations—as the most promising escape from high cost of underground.

WASHINGTON COMMENT

By R. N. LARKIN

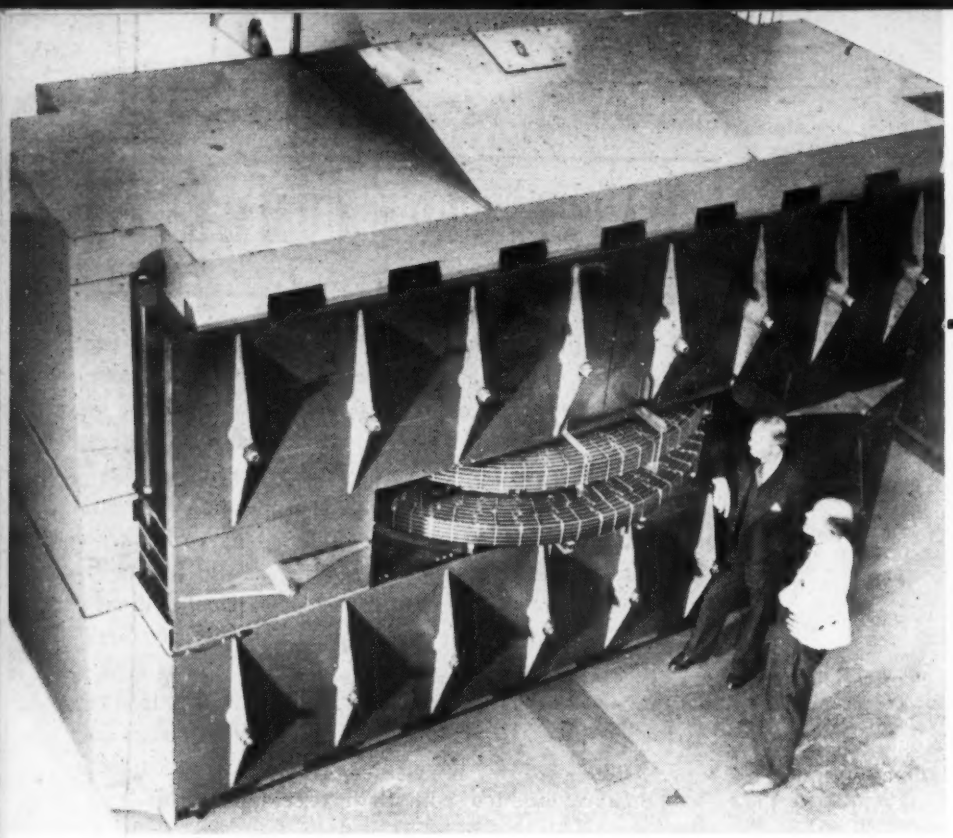
FOR some time, Congress has been studying broad tax revision. The results are expected to have at least some effect upon cooperatives. Rural electrification co-ops, of course, enjoy federal tax exemption. Naturally, they want to keep it. This is the purpose of REA's "capital credits" plan. The plan isn't new, but REA is pushing it hard, particularly as Congress nears action on tax revision.

"Capital credits" is a bookkeeping scheme to credit revenues in excess of the cost of electric service. Ordinarily, a co-op returns such excess revenues to its members periodically. On the basis of such practice, co-ops argue that they have no net income, thus may not be required to pay income taxes. Under "capital credits," REA co-ops do not return such excess payments, but use them as capital. Members are credited with their excess payments, pro rata. Obviously, this process must be followed, or REA loans never could be repaid.

Suppose, for instance, you pay a co-op $100 yearly for electric service. Suppose it cost the co-op $75 yearly to furnish this service. The co-op would keep the $25 and credit you with that much "patronage capital," as REA describes it. The $25 helps to retire the federal loan.

Now, one day, the federal loans behind each REA co-op will have been paid off. At that time, co-op members will own the systems which remain. They will have accumulated tangible capital they did not possess when they began serving themselves. This accumulation of capital will have been derived from net income. Certainly this is true if net income be defined as the difference between gross income and all expenses. The accumulation of net income which co-op owners will possess at the end of the first 35-year cycle (federal electrification loans bear 35-year repayment terms) will not have been subject to federal income taxes. Whether or not it should be taxed is what Congress is studying now.

Where "capital credits" really seems to get off the track, though, is in its provision for the ultimate retirement of "patronage capital" credits. Suppose, for instance, you have been paying $25 per year above the cost of service for 35 years. Each year, it has been credited to you, and used as capital by the co-op. At the end of 35 years, you not only are part owner of an electric system but you also may look forward to having the $875 which you have accumulated in "patronage capital" credits repaid in cash. It may be assumed that it would take a second 35-year cycle to retire the "patronage capital" credits accumulated during the first 35 years. So, if you were on hand when the co-op started, you probably won't be there when the pay-off is completed 70 years hence. No one seems to know whether the "patronage capital" credits—or your share of the system—will be part of your estate.



130-TON 100,000,000-electron-volt betatron and Dr. E. E. Charlton (left), head of the X-ray section of the G.E. research laboratory, and W. F. Westendorp, who were responsible for its design and construction

MAGNETIZING POWER for the betatron obtained from this bank of 24,000-volt, 1,000-amp capacitors, the largest single bank of units ever assembled

Power Supply

F. L. KAESTLE
Industrial Engineering Divisions,*
General Electric Co
Schenectady, N. Y.

IN THIS ATOMIC AGE, many of the research tools in the field of nuclear physics require substantial amounts of power and impose special power-supply problems.

A typical example is that of the 100-million-volt betatron, otherwise called an induction electron accelerator (see Fig. 1.)

Other new tools include the cyclotron, the synchrontron, and variations of them.

Betatron Operation

Purpose of the betatron is to produce a beam of very high-velocity, high-energy electrons, or beta rays; hence the name "betatron." The electrons are injected into a 66-in. orbit diameter, doughnut-shaped, highly evacuated tube, by applying a pulse of energy to the hot wire filament of the so-called electron gun.

The tube is located in the air gap between two specially shaped pole pieces of a large single-phase, 60-cycle magnet. The power-supply coil of the magnet is, in effect, the primary of a transformer; the circular stream of electrons is its secondary. In each cycle, as the flux increases, the electrons circle the center orbit of the tube. They acquire an additional energy of approximately 400-electron-volts† per revolution; just as a conventional copper coil would acquire a potential of 400 volts per turn. If the center-orbit-magnetic balance were not disturbed, the electrons would make approximately 250,000 turns in the quarter-cycle rise of flux from zero to maximum.

* Chemical and Petroleum Division.

† An electron-volt is the energy which one electron acquires when accelerated through a potential difference of one volt. Therefore the electrons in their orbit of the 100-million-volt betatron have the same energy as though they are accelerated between the cathode and anode of a 100-million-volt vacuum tube. The betatron is simply a device to accomplish this result practically, without resorting to such high voltages, and to produce an X-ray beam in free air for experimental work.

for the 100,000,000-Volt Betatron

Pulsed electrons accelerated in secondary of transformer-magnet excited from 24,000-kva capacitor-bank reservoir . . . Single-phase power load is balanced on 3-phase system

However, by applying a pulse of energy to a set of orbit-shifting windings in the pole-face slots of the magnet, the electrons can be forced to leave their normal orbit; to impinge upon a suitable target in the tube, and thereby produce a beam of X-rays.

By accurately controlling the time interval between electron injection and orbit-shifting pulses, the voltage or energy of the X-ray beam may be adjusted to any desired value from 10- to 100-million electron-volts, and repeated continually, once each cycle.

Betatron Components

The betatron itself, exclusive of its power-supply equipment, consists of:

(a) *The magnet.* This is essentially a large (130-ton) air-cooled, single-phase transformer, with power supply and magnetizing windings; with special pieces, having mounting provisions for the tube in the air gap.

(b) *The capacitor bank.* A power-factor-corrective equipment to supply magnetizing current to the magnet. It consists of 24,000 kva of rack-mounted capacitor units with buses, insulators, and fuses.

(c) *Cooling equipment* for the magnet and capacitor bank; motor-blowers and filters.

(d) *Electronic, vacuum, and control equipment.* This is the "heart and brains" of the betatron.

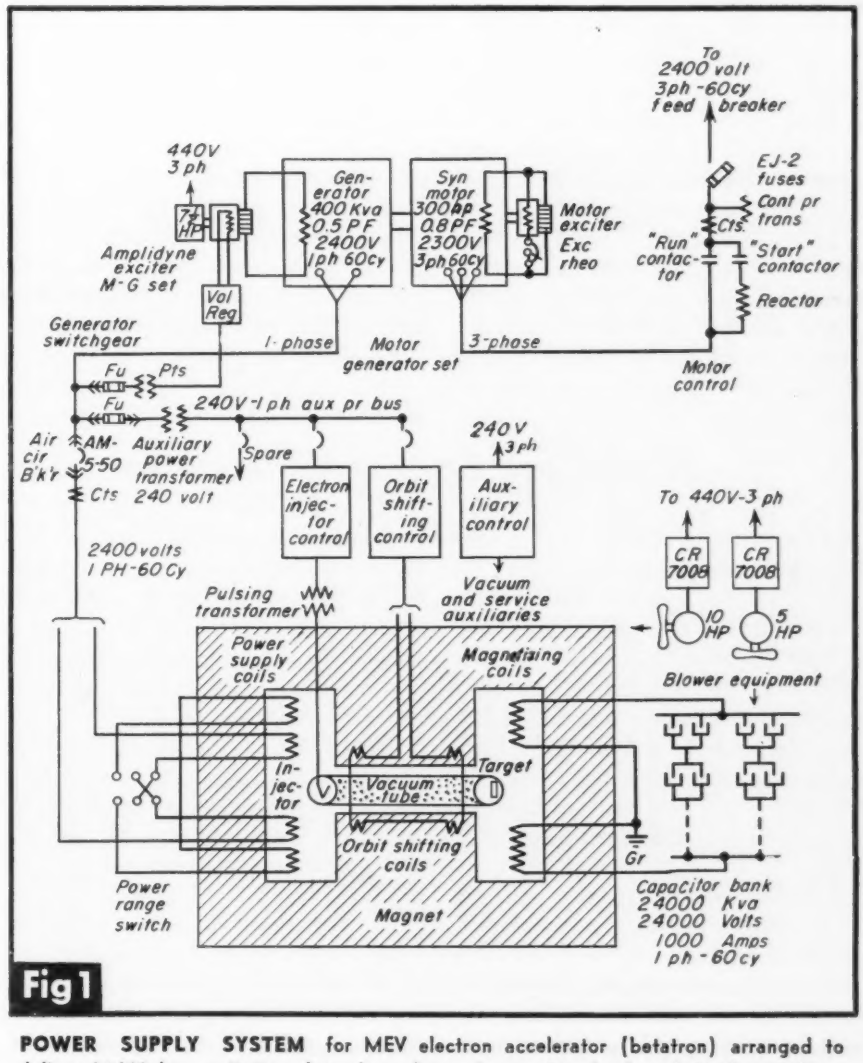
Broadly, the latter equipment consists of:

1. The vacuum tube, with its electron injector, target, and evacuating equipment.
2. The power-supply and control cubicles for the electron injector, orbit shifting, and auxiliary control.
3. X-ray indicating equipment.
4. The operator's control and instrument desk for remote operation of the entire equipment.

Power must often be supplied to such equipments from limited power systems. The load characteristics must be acceptable to the available power supply, without imposing restrictions which would limit the best use of the research tool itself. Therefore, the selection of suitable power-supply equipment requires careful consideration.

Power-Supply Requirements

Because of its size and its large air gap, the magnet would require a power supply of 24,000 kva, at a power factor of less than 1 percent, if no corrective measures were taken. For this reason, a set of magnetizing coils is added to the magnet and connected to the 24,000-kva capacitor bank. For normal continuous operation, the resultant power factor is then unity, and 200 kw of power are required to supply the losses of the



POWER SUPPLY SYSTEM for MEV electron accelerator (betatron) arranged to deliver 24,000 kva excitation through medium of capacitor bank and 300-hp, 3-phase, motor-generator set

magnet and of the capacitor bank.

However, several conditions must be recognized in selecting the power-supply equipment:

(a) The load is 200 kw, 2,400 volts, single-phase. Because of the phase unbalance which would result on a 3-phase system, this is a larger single-phase load than is permissible on the systems that are usually available to research laboratories.

(b) Although the power factor is unity for continuous operation (when ideally tuned), allowance must be made to permit the power supply to vary from 333 kva, 0.6 pf lagging to 333 kva, 0.6 pf leading. Even this allows only a plus and minus 1 percent variation in the 24,000 magnetizing kva to compensate for "error" and "warm-up" departures from ideal. It is impractical to attempt to better power-factor correction of the magnet itself, even though the variation represents a wide swing on the net kva required.

(c) The capacitor bank must be charged each time the magnet is energized. If a full-voltage power source is used, then starting resistors and a sequence of starting contactors are needed to limit the starting current to acceptable increments.

(d) For best operation of the betatron, a voltage regulation not greater than plus and minus 1 percent from a "fixed normal" is highly desirable. Practically all available systems have a voltage variation of plus and minus 5 percent; no "fixed normal" in that range can be chosen.

Power-Supply Equipment

The least expense, complication, and space requirement can be realized by imposing the single-phase magnet load on any 2,400-volt, 3-phase source. This is done by a load-ratio-control auto-transformer and adequate starting resistors and contactors. The switchgear for the magnet and auxiliary circuits is required in any case and is common to any system chosen.

However, by the use of a synchronous-synchronous motor-generator set, 3-phase to single-phase, with amplidyne-voltage-regulating equipment, and with reduced-voltage-starting control, the desirable operating conditions of the betatron can be obtained, while only normal conditions are imposed on the power system. Therefore, the power-supply equipment which is being furnished for present installations consists of:

(a) A motor-generator set having a 300-hp, 1,200-rpm, 0.8-pf, 2,300-volt, 3-phase, 60-cycle synchronous motor, and a 400-kva, 0.5 pf, 2,400-volt, single-phase, 60-cycle synchronous generator. The direct-connected exciter is for synchronous motor excitation. The generator is designed specifically for a 400-kva, single-phase load, and for a transient reactance of less than 25 percent (its equivalent 3-phase normal reactance rating is over 750 kva).

(b) A reduced-voltage, primary-reactor starting and control equipment for the synchronous motor.

(c) An amplidyne exciter set for the generator.

(d) An electronic voltage-regulating equipment.

(e) A metal-clad switchgear equipment, including a circuit breaker for the generator and magnet, and fuse-protected potential and auxiliary power transformers.

The motor-generator set is started, perhaps once a day, and is adjusted to 0.8 pf leading at full load. This provides a balanced 3-phase load with needed reactive kva for system power-factor correction. Reduced-voltage, reactor starting eases the duty on the supply system.

The generator breaker is closed. The generator voltage is then raised gradually to charge the capacitor bank to full voltage. At full voltage, the electronic voltage regulator, with amplidyne exciter, will maintain voltage within ¼ percent of any preselected "normal" from 2,300 to 2,700 volts.

The small amount of power for the electron-injector and orbit-shifting supplies must be synchronous with the magnet supply; their auxiliary power transformer is also supplied from the generator.

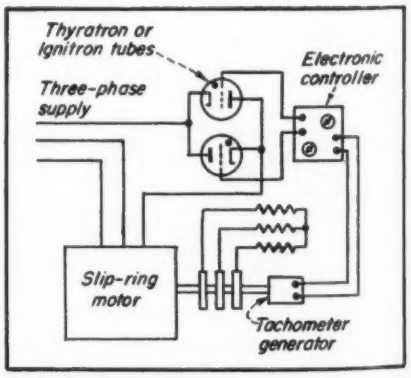
Electronic Speed Control for Slip-Ring Motors*

ACCURATE CONTROL of motor speed in the range of 2 to 25 percent of rated rpm can be provided by alternately applying three-phase and single-phase current to the primary of a slip-ring motor. A combination of electronic tubes, a tachometer generator and suitable electronic control circuit acts as a switching device to vary the duration of three-phase operation during each half cycle.

A preset reference voltage selected by adjustable contact in the control circuit is imposed on the grids of a pair of inverse-parallel connected thyratrons or ignitrons. This results in full three-phase current with 125 percent torque in starting. As the preset speed is approached, tachometer voltage bucks the reference voltage until the phase of the grid voltage is sufficiently retarded to supply just enough three-phase power to maintain desired speed.

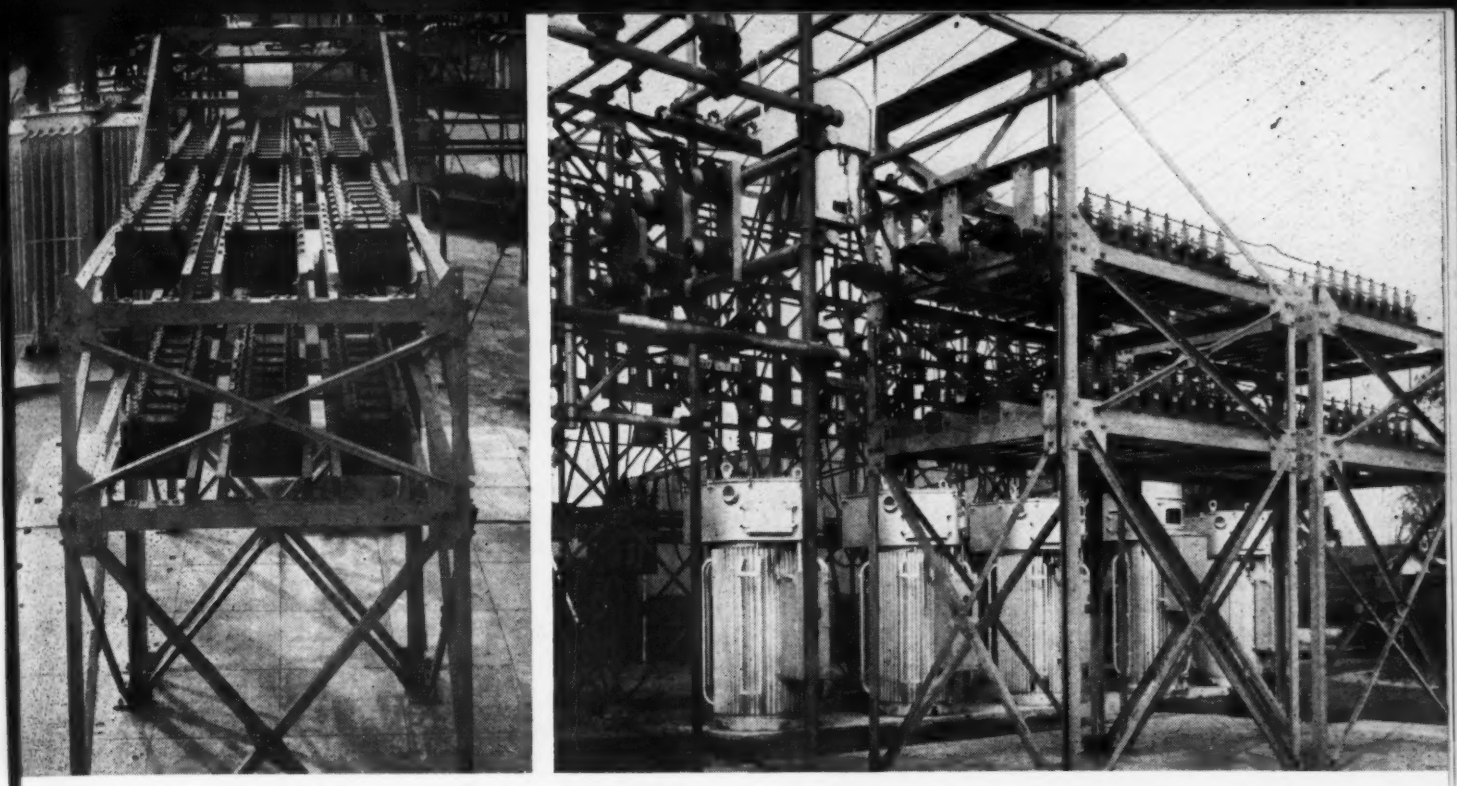
Thyratrons can handle up to 10 hp at 220 volts, 20 hp at 440 volts while ignitrons handle larger motors up to 250 hp at 220 volts and 500 hp at 440 volts. Installations were made on 5-, 25-, and 150-hp ratings.

Of course operation at low speeds means an increase in motor heating as a result of reduced fan action. Increased heating from this method of speed control is insignificant in normal threading speed ranges for periods of an hour or two, although a different type of drive might be more appropriate for long-continued operation at creeping speeds.



ELECTRONIC TUBES in one phase of primary connection, with tachometer controller, pass only part of phase current necessary to hold speed accurately

* From a paper by W. H. Elliot, Cutler-Hammer, Inc., presented at National Electronics Conference.



STANDARDIZED STEEL RACKS mount capacitors in banks of 48 units in vacant substation space. Bus tie breakers cut capacitors in and out where switching is necessary. Otherwise, capacitors are tied in solid through disconnect-grounding switches

Capacitors Switched by Bus Tie Breaker

A. A. STRAUB
Southern California Edison Co
Los Angeles

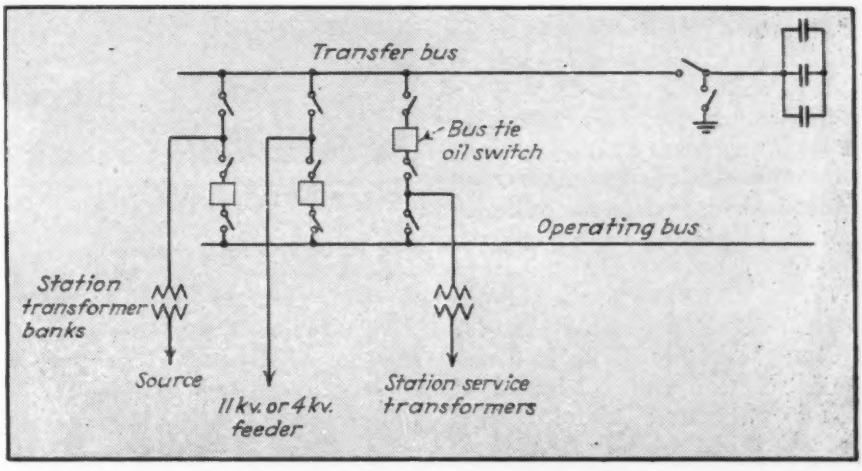
Available equipment and space are utilized and man-hours made to go further by installing capacitors at distribution substations instead of out on feeders

IN ITS PROGRAM to get a large amount of capacitive kvar on its system as quickly as possibile and with maximum use of existing facilities, Southern California Edison Co is installing capacitors at distribution substations and using the bus-tie oil circuit breaker for switching them wherever possible.

Capacitors out on feeders or at the customer's service bring the greatest benefits, of course. But there is space already available at substations and bus-tie breakers can be used for switching. This and the urge to get the most capacitor installations for the man-hours expended, has led the Edison company to its present practice. Last year, 50,000 kva in capacitors was installed and this year will see another 40,000 kva added.

Support Rack

A standard steel support rack, shown, is used. This rack was designed while waiting for delivery of steel cubicles. It proved so satisfactory that the original idea of using the steel cubicle units will probably be abandoned. The rack is made in sections each of which will accommodate 48 of the 15-kva capacitor units. Desired capacity is obtained by simply adding rack sections for units in multiples of 48. The two-section rack illustrated mounts 96 units, or 1,440 kva. In this particular installation, the oil circuit breaker shown is of small capacity and is being used temporarily as an oil dis-



SINGLE LINE of typical arrangement with capacitors connected to transfer bus. Transfer bus disconnects are normally open to station transformer bank and all feeder circuits. All disconnects and the oil switch are normally closed to bus tie positions

connecting switch only. Ordinarily, capacitors are connected to the transfer bus and the bus-tie breaker used to switch them in and out where necessary. This switching is done manually by an area service man. It is not considered worth-while to provide automatic switching—for the time being at least. In case of trouble that requires placing a feeder on the transfer bus, both capacitors and feeder are on the transfer bus. This condition occurs so rarely however, that any temporary disconnection of the capacitor bank at a time when feeder switching is taking place is not considered to be a serious operating matter.

Isolating Disconnects

At the time the first capacitor installations were made, suitable individual unit fuses were not available, so the capacitors were connected in solid except for the circuit breaker protecting the capacitor bank as a whole. The few cases of unit failures have simply burned the units clear. One case due to lightning successfully relayed the oil switch but bushings were damaged on two units that were adjacent to the one unit that failed.

All installations are provided with isolating disconnects and short circuiting grounding disconnects, of various arrangements depending on the type and location of the oil switch protecting the capacitors. About half of the capacitors installed in substations have been installed on the 4-kv buses of the 11/4-kv or 16/4-kv distribution stations, and approximately half on the 11-kv buses of the 66/11-kv substations.

All capacitor banks have been wye connected with an isolated neutral using standard 2.4-kv units on 4 kv and 7.2-kv units on 11 kv. Each unit is tested to determine the current at rated voltage and then the units are banked to obtain balanced three-phase current. The wye-connection was selected because of the economy of the lower voltage units made possible thereby. Moreover, delivery was expedited because units were standard stock items that were readily available for the installation.

When the pressure of the present period is eased, consideration will be given to the installation of permanent switching provisions with possibly some automatic switching. Also the need for individual unit fuses will be reviewed. The satisfactory experience to date will undoubtedly temper thinking with respect to requirements of the individual fuses.

Conductor Support

A feature of the standardized rack, as may be seen, is an extension of one end to provide a dead-end structure for conductors feeding the rack. Also the rack channels are spaced to accommodate the mounting flanges of the capacitor units, thereby providing a very convenient mounting arrangement.

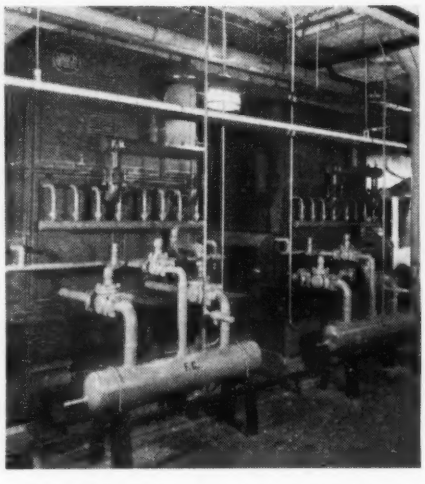
The combination of circumstances which led to doing some of the things mentioned seems to have been a blessing in disguise, because experience has proved that capacitors can be successfully operated with only the provisions mentioned.

Electricity Keeps Drug Plant Clean

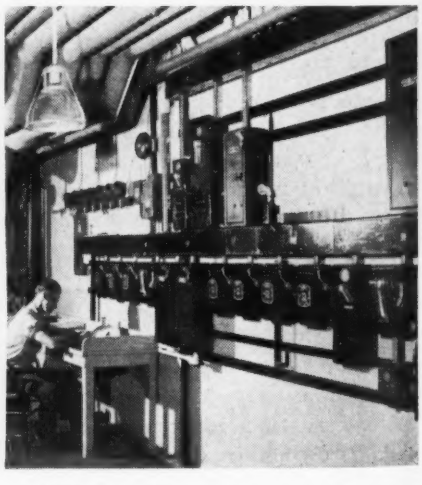
POST-WAR specialized factory buildings, where they can be built new from the ground up, can have and should have all electric and other facilities "built in" the structure. An excellent example of a single-purpose reinforced-concrete building is the pharmaceutical-packaging plant of Winthrop Chemical Co at Rensselaer, N. Y., designed and built by Austin Co.

Suspended ceilings allow space for electrical distribution and piping as well as ventilating ducts. This arrangement of ceilings also allows for recessed fluorescent lighting fixtures; glass-inclosed, flush mounted to afford minimum surface for collecting dust and to provide lighting intensity of 30 ft-c.

Prime requirement of the building is that it be sealed completely. Outside air enters only through the air-conditioning system, and is cleaned of dust by Precipitrons and irradiated by bactericidal lamps. Glass-block panels admit some natural light to avoid a "shut-in" effect, but furnish a near-perfect air seal.



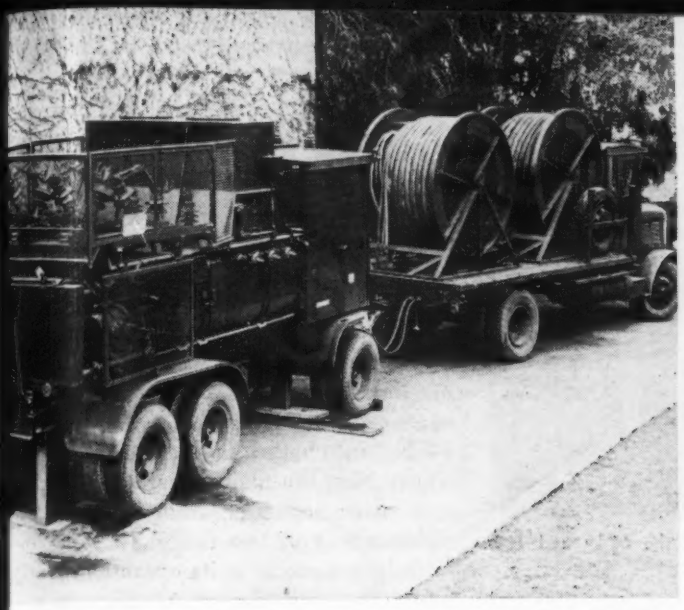
CLEANLINESS in design penetrates into all machinery spaces. All motors for air conditioning, compressed air and vacuum are under remote control



CONTROL PANEL for air-conditioning system, Precipitron dust-removal apparatus and ultraviolet radiators, all centrally located in basement room

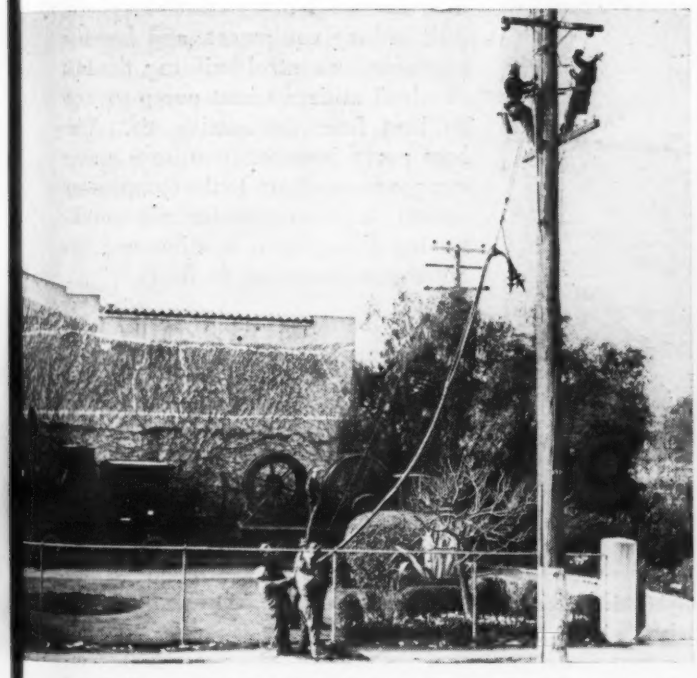
The heating system, using steam from an adjacent boiler unit, holds 70 F with outside minus 10 F and 15-mph wind velocity. Normal working spaces can be held to 77 F dry bulb, 65 F wet bulb in summer under automatic control. Silica-gel units keep certain compartmented processes to a relative humidity of 25 percent.

Refrigeration load assumes 350 persons, 150 kw of power and lighting. Ampule-sealing machines burn 535-Btu gas at rate of 1,500 cu ft per hr. Outside air for ventilation is brought into the plant at the rate of 8,000 cfm.



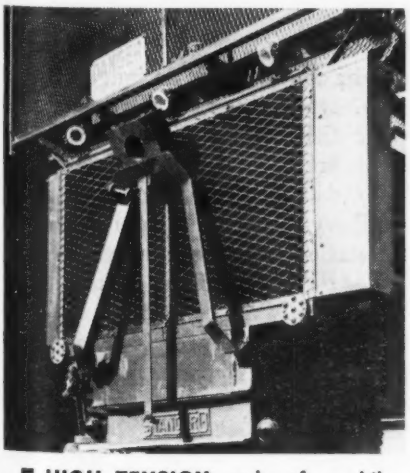
1 MOBILE SUBSTATION AND CABLE TRUCK ARRIVE. Substation is a 2,500-kv, 11- and 22-kv to 4-kv General Electric unit

2 UNREELING PRIMARY CABLE. This No. 1/0, 22,000-volt cable has moulded crotch and pigtails at each end. Pigtails are 12 ft long



3 PRIMARY CABLE being hoisted up pole for hot line connection to 12-kv circuit

4 MAKING SUBSTATION CONNECTIONS on 4-kv secondary cable. This is 600,000 cir mil, 5,000-volt, 250 ft long



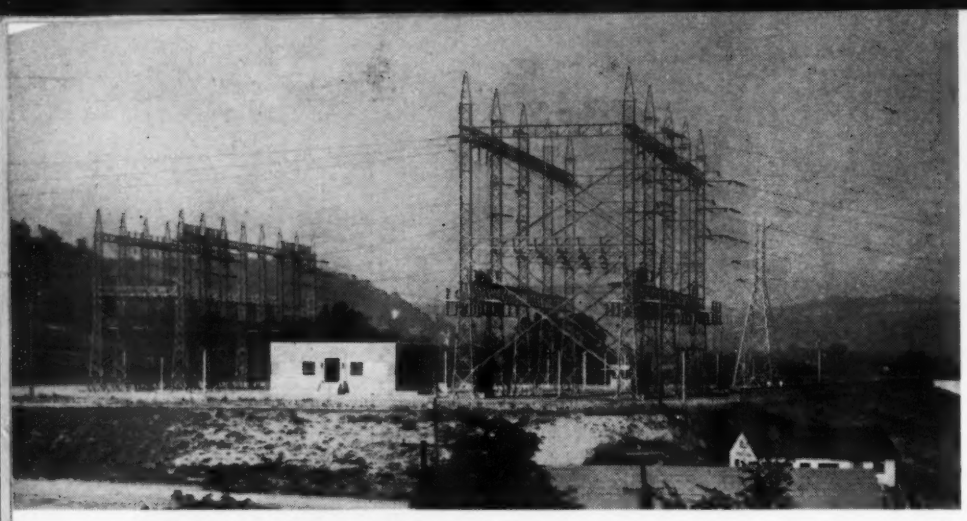
5 HIGH TENSION end of mobile substation showing hinged bracket and circular porcelain insulator

Mobile Substation Leads

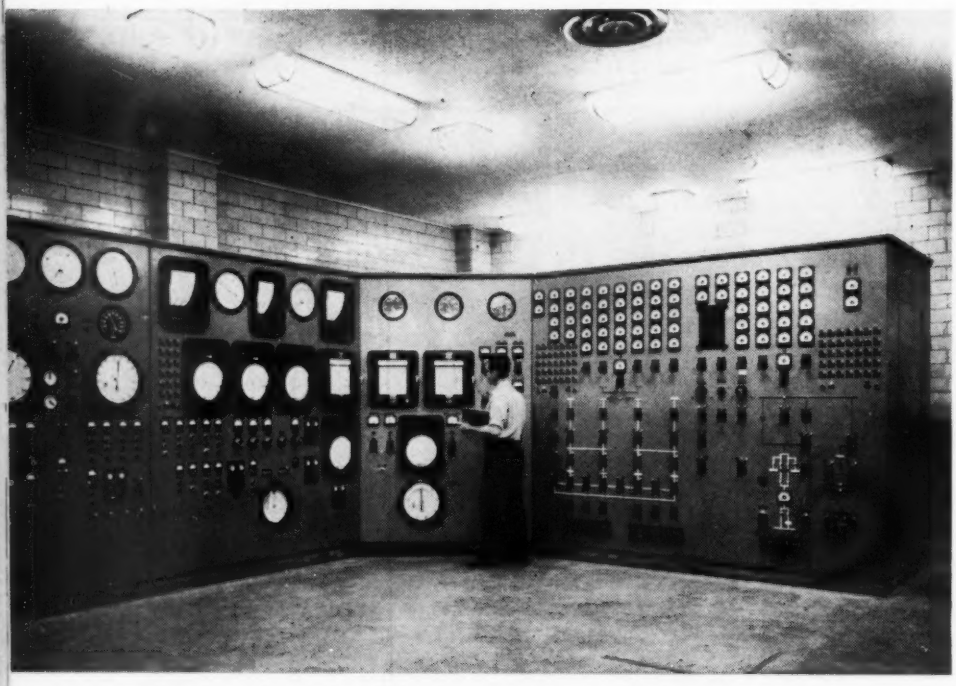
SETTING of temporary poles and other difficulties of making open-wire connections to mobile substations have been obviated by Pacific Gas & Electric Co through the use of Okonite special primary and secondary cable leads. Various phases of making connections and details of equipment are shown in the accompanying staff photographs.

Time saving is an important factor in the use of the cable leads, since the principal value of the mobile substation is for providing emergency service. Special construction of the cable permits rough and repeated handling. Permanent factory-made pigtails at both ends, color coding to facilitate phasing, and factory-built steel reels are other features.

Tidd Plant



SWITCHYARD CONTROL HOUSE at Tidd Plant located between the 66-kv and 132-kv structures, both of which are designed for two buses



CONTROLS FOR THE GENERATORS and plant auxiliaries are at right side of control room switchboard, boiler controls in center, and turbine controls at left

FREDERIC A. LANE
Electrical Engineer
American Gas & Electric Service Corp

SIGNIFICANT ASPECTS of the switchyard, auxiliaries, controls and communications of Tidd Plant* are these:—

The 66/132-kv switchyard is entirely automatic. The control building is heated and air-conditioned by a heat pump. Auxiliaries are supplied by alternative sources. Electronic relays are used in conjunction with the automatic synchronizing. Comprehensive communication has been provided.

The 132-kv portion of the switchyard will eventually have two buses, with only one provided for the first unit. Addition of the second bus will enable use of a second generator breaker ensuring against loss of capacity in case of bus trouble. While only one feeder is connected to this bus initially, added generators and the growth of load will require more. They will be normally operated equally divided between the two buses. The breakers are rated 3,500,000 kva, will interrupt in 3 cycles, and are designed for ultra-high speed reclosing on a 20-cycle basis.

The 66-kv portion of the switchyard has a double bus with the 66-kv terminals of the auto-transformer bank connected through two breakers, one to each bus, so that in series they serve as a bus tie. The breakers are rated 2,500,000 kva, with interrupting time of 5 cycles and are capable of 20-cycle reclosing.

The switchyard is located about 800 ft from the main generating station, being separated from it by the rights-of-way of two railroads. It is entirely automatic in its operation, is independent of the generating station, and needs no attendant. It has all the facilities normally provided in any isolated substation. It has its own storage battery control system, oil handling equipment, and heating plant for the control building, the last of which utilizes a heat pump getting its heat from the outside air. The heat pump installation utilizes water storage as auxiliary to the compressor system, is reversible for air conditioning during warm weather, and has automatic defrosting facilities.

Auxiliary Power System

The plant auxiliary power system is designed to have the highest degree of service reliability consistent with economy of design and operation. The principal source of supply stems from the generator leads through two conventional self-cooled, three-phase, 6,667-kva, forced-air-cooled transformers. The two 2,300-volt buses are built into factory-assembled metal-clad switchgear, and use remote-controlled air breakers. They are located in adjacent rooms in a basement area between the boilers and the generators. The two three-phase, 69-kv reserve auxiliary transformers, also of conventional design, are rated 6,667 kva with forced air cooling, and serve the 2,300-volt buses when desired in place of the former units. They will be arranged to serve the auxiliary buses of all future units in the station in the same way.

For the lower voltage motors, what is essentially a ring bus has been set up. This has been divided into four parts, each served by a 2,300/600-volt, three-phase step-down transformer connected to one of the 2,300-volt buses. These 1,875-kva, forced-air-cooled units installed close by their respective 600-volt buses are

* For discussion of the steam-end, generators, transformers, etc., see ELECTRICAL WORLD, August 2, 1947, page 60, and August 16, 1947, page 68.

Electrical System Advances New Ideas...II

askeral insulated. In case of failure of one of them, there is ample capacity in the transformers on adjacent bus sections to handle the situation. Two of the bus sections are situated in rooms above the 2,300-volt switchgear and the other two are in the turbine room basement close to the motors they serve. The 600-volt switching is made up of metal-clad, remote-controlled air circuit breaker equipment.

The auxiliaries are served by delta-connected ungrounded neutral systems with ground detectors on each bus to warn of difficulties and give time for locating and clearing grounds before they develop into short circuits. Loss of the normal source of power to a bus results in automatic tripping of the breaker connecting that source and the closing of an alternate source breaker.

Coal Handling

One feeder from each of the 2,300-volt auxiliary buses serves the coal handling equipment through two 1,500-kva, oil-insulated, self-cooled, 3-phase transformers stepping down to 600 volts at the coal handling substation. The automatic coal handling equipment utilizes metal-clad air circuit breaker type switchgear. The main breakers are manually operated.

The use of two auxiliary transformers is obviously more expensive than that of a single large unit. It makes possible, however, the employment of much lower rated auxiliary switchgear so that the over-all savings are considerable. It also serves to eliminate load unbalance between the two windings of the generator, which, while not serious, is undesirable. Of no little value is the diversity of risk to equipment. Should station reserve auxiliary transformers ever have to be replaced by larger ones because of larger sized future generating units being installed, they will find ready employment in any one of a relatively large number of step-down substations. Otherwise a single large unit would be much too large for this purpose.

Switching completely automatic . . . Alternative power sources for auxiliaries . . . Ring bus for low-voltage motors . . . Auxiliaries monitored for grounds . . . Electronic synchronizing relays . . . Comprehensive communication

The auxiliary drives are entirely electrical and comprise a total of nearly 15,000 hp in connected load. A major portion of this load is in 14 motors ranging in capacity from 300 hp for forced-draft-fan drives to 1,000 hp for boiler feed pump motors. These are connected by individual breakers to one or the other 2,300-volt bus. These are arranged so drives of like function will be as evenly divided as possible between the two. Thus only in those cases where there is a single drive for a given vital function will the loss of an auxiliary bus result in complete unit shutdown.

The remaining 158 motors, ranging in size from ¼ hp to 250 hp, are served from the 600-volt buses. In large measure the smaller of these are grouped so that one breaker will control several motors, each individual motor having a magnetic switch or a starting device. Where required, separate fuses are provided for individual motors. The larger and more important motors have individual breakers.

Relay Protection

Relaying is simple and in accordance with the most modern practice. The 132-kv and 66-kv buses each have differential relay protection. Each 132-kv and 66-kv circuit has one-cycle carrier current relaying. This is in addition to two phase and one ground inverse time relays and two phase and one ground instantaneous relays.

The main generator transformers have percentage unbalance differential relay protection, while the generator, in addition to percentage unbalance differential relays, has a ground relay of the high speed inverse time type. A third differential relay system across the combined transformer and generator unit uses inverse time relays.

Differential relays are used to protect the auto-transformer bank between the 132-kv and 66-kv yards.

Automatic synchronizing of the generator and feeder breakers is accomplished with electronic relays, and an automatic oscillograph has been provided for recording disturbances on the system to assist in studies of causes and for aiding in providing remedies.

Communications

Most effective operation of a modern steam-electric generation plant is dependent upon adequate communication facilities which are a far cry from those considered sufficient 20 to 25 years ago. Tidd communications permit all personnel to be in constant touch with each other no matter where they are. Orders may be transmitted and acknowledged swiftly. Emergencies may be reported to all concerned as soon as they occur. To provide this effective service, four means of communication have been installed, as follows:—

(1) Intercommunicating and outside telephones.
(2) Carrier current telephones.
(3) Public address system.
(4) Test telephone system.

Wire telephone facilities for communication with the outside and intercommunication are provided by the Consolidated Telephone Co of Ohio through a private automatic exchange in the plant. The present 42 dial handset telephone stations may be increased without limit. Nine stations are in sound-proof booths in noisy

places, six in the various yards outside, and two are in the locomotive shop. Any number of stations up to five may be combined in a conference circuit. An associated code call equipment allows for 45 combinations with eight alternating current horns distributed throughout the plant providing audible signals. Incoming calls via any of four trunks from the Telephone Exchange in the town of Brilliant are controlled manually from an attendant's cabinet. During the day this can be operated from the time keeper's quarters at the plant entrance. At night a cabinet can be operated by the watchman at the gate, relieving other personnel of this duty. Any station may reach the Brilliant exchange by dialing.

Carrier Current

Carrier current telephone is used on the outgoing high-voltage circuits. The 49-kc system on the Wagenhals 132-kv circuit allows communication with all of the major substations and generating stations of The Ohio Power Co in the eastern and southern portions of the State. The 60-kc system used on the 66-kv lines allows for communication with the Windsor Power Station and with all of the major substations of The Ohio Power Co in the divisions along the Ohio River, and with Wheeling Electric Co.

Both of these carrier current systems may be controlled from either the control building in the switchyard or the control room in the plant. At both of these points there are loudspeakers and ringers. The equipment itself is located in the control house in the switchyard, is of the single-frequency type, and provides fully selective calling both in and out.

For most rapid communication throughout the plant, a public address system has been installed, with amplifiers located in the communications room. Thirty-seven speakers distributed over the entire plant and in the substation control building are actuated from 25 locations. Here are installed headlight type dynamic microphones on steel boxes containing a control switch. Monophone type handsets are used at nine stations because of noisy surroundings. Besides ordinary microphones in the control room, nine control panels have jacks for plugging in portable microphones. Loud speakers in offices are of the wall type and have volume controls, while elsewhere various sizes of horn type speakers are used, depending upon background noise level and coverage required. All microphones are in parallel on one common circuit and all speakers in parallel on another.

The test telephone system is a comparatively elementary affair. It consists of 60 jacks scattered throughout the plant and bridged across a single twisted pair of No. 12 wires. Communication may be established between any two points by plugging in standard monophones using transmitters and receivers in series. Sectionalizing facilities at frequent points enable faults to be rapidly located.

Control Batteries

Three 120-cell lead batteries supply the necessary energy for the control systems. The plant itself has two batteries physically isolated from each other. One is a relatively large battery that is rated 320-amp-hr. This actuates valve control equipments and other devices of whatever nature requiring large amounts of sustained direct-current power. A smaller 243-amp-hr battery energizes the control buses for relays, breakers and protective equipment in general. Switching permits either battery to serve both functions. The three 15-kw motor-generator chargers, two of which normally float on their respective batteries, may be used interchangeably or paralleled for overcharging.

The switchyard has its own 210-amp-hr battery with two 5-kw motor-generator chargers and operates entirely independently of the plant system.

The control room on the main floor between the boilers and turbo-generator contains all the panels, both for steam and electric control, essential to plant operation. The main board, which is horseshoe shape in plan, has the turbine controls on the left, the boiler controls in the center, and the generator controls at the right. The panels, which are vertical, are painted a light blue color, which in combination with the control lighting is calculated to be pleasing to the eye. Flush-mounted instruments are used. Mimic buses help to simplify operation. Relays and test equipment are mounted on vertical panels placed back to back with the generator controls. Colored panel wiring makes circuit tracing easy, and the back of the board is enclosed to keep out dirt. In front of the open end of the horseshoe and facing it is a row of panels including hydrogen control and other auxiliary equipment. The arrangement lends itself to ready operation of the entire boiler and turbine generator unit by two men. A similar control board in a separate control room will be provided for each future generator unit as it is installed.

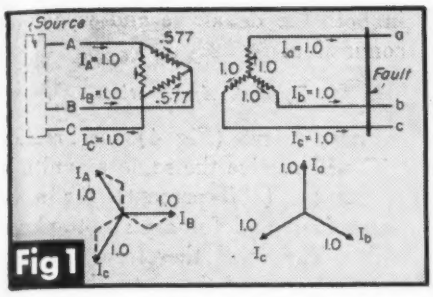
In the plant, however, there are no facilities for switchyard control; this latter is taken care of by a vertical panel board in the switchyard control building. The switchyard control board is similar to that in the main plant, except that instruments are surface mounted.

Control cables are placed in open troughs below the switchboard and are carried throughout the plant in this manner. Very little individual conduit construction is used and this mostly in short isolated lengths at equipment locations. In the switchyard the control cables are carried in a cable trench from which individual cables may be buried directly in the ground, with short lengths of duct for groundline protection. The cable used indoors is made up of separate conductors, each insulated with a synthetic compound over which is a layer of asbestos covered with a coded colored cotton braid. Over the bundled conductors is a hard finished fireproof asbestos braid. The cable used out of doors differs in that the individual conductors are each covered solely with a coded colored synthetic insulation, while the bundled conductors are covered with a tough rubber belt for mechanical protection.

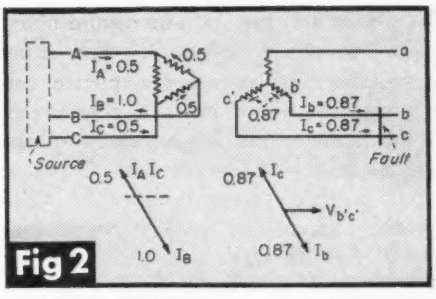
Emergency Provision

Lighting is supplied through two transformers connected to two different auxiliary buses to guard against interruption, with a portion of the lighting arranged to be switched automatically to the larger control battery for a short period in emergency.

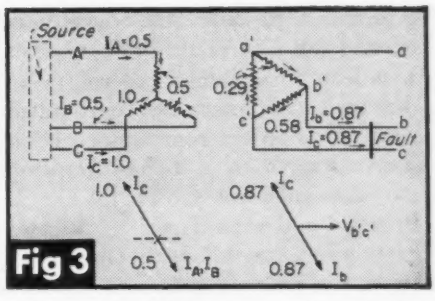
A motor-driven, 300-kw exciter and 7.5-kw pilot exciter set has been provided below the turbine room floor to serve in emergency for this and future machines.



DIRECTION of fault currents for a 3-phase fault on wye-side of delta-wye transformer bank



FAULT CURRENTS for a phase-to-phase fault on wye side of the transformer bank in Fig 1



FAULT CURRENTS for a phase-to-phase fault on delta side of a wye-delta transformer bank

Relaying Delta-Wye Transformers

S. L. SCHEFFER
Protection Engineer
Long Island Lighting Co
Mineola, N. Y.

THE basic principle for the coordination of tandem-phase induction overcurrent relays has long been stated as follows:

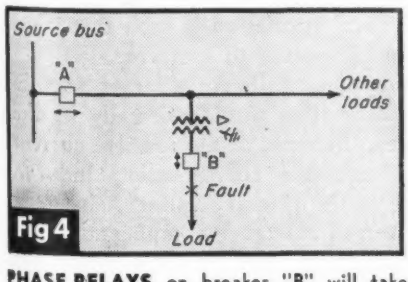
"For relays with similar characteristics set pickup between maximum load current and minimum fault current and provide a time interval of coordination at maximum fault current."

But for coordination of overcurrent relays through either wye-delta or delta-wye transformers, the established time interval of coordination should be between 87 percent of 3-phase fault currents, on the fault side, and 100 percent 3-phase fault current for relays on the source side. Unless this is done the results may be unsatisfactory; particularly with very inverse relays or with long relaying time.

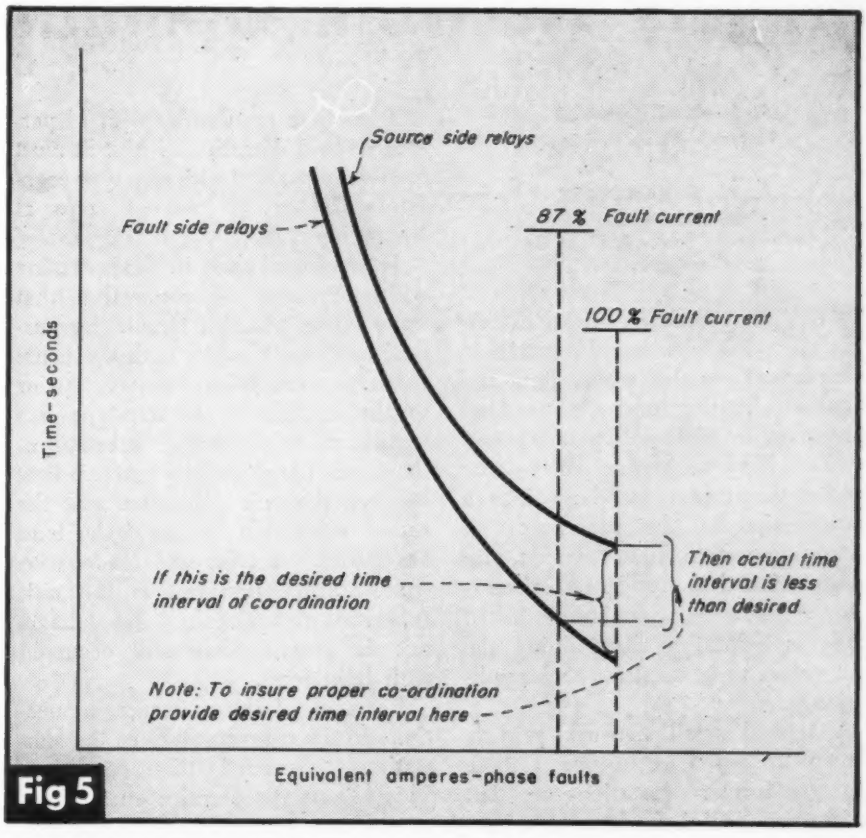
It should be noted that ½ sec at maximum fault current is usually provided between sequentially tripping breakers. This allows for: (1) Variations in calculations and performance of relays and current transformers, and (2) Time consumed in the control circuit and breaker from the instant the relay contacts close to the time the breaker clears the fault. With several breakers in series the half-second intervals begin to pile up, even after taking into account the increase in current as the fault approaches the source. This can result in excessive relaying time. It may be necessary to reduce the coordination interval to 0.4 sec but as the time interval is reduced it becomes more important to consider all determinable factors.

Delta-Wye Transformers

A 3-phase fault is frequently assumed to determine the maximum fault current at which successive phase relays are coordinated. But



PHASE RELAYS on breaker "B" will take longer to close trip contacts on 87 percent phase-to-phase fault current than on 100 percent 3-phase fault


Source side relays
Fault side relays
87 % Fault current
100 % Fault current
Time - seconds
If this is the desired time interval of co-ordination
Then actual time interval is less than desired
Note: To insure proper co-ordination provide desired time interval here
Equivalent amperes-phase faults
Fig 5

COORDINATION PRINCIPLE for delta-wye connection

this may lead to trouble where fault current flows through a delta-wye or wye-delta transformer and relays on the fault side must be coordinated with relays on the source side. Fault currents for a solid 3-phase fault on the wye side are shown in Fig 1. Primary and secondary line voltages have been assumed equal. Obviously, for a wye-delta transformer with assumed terminal voltage ratio of 1:1 the line current ratio is 1:1 and the turns ratio is 1.73 (delta side): 1.0 (wye side).

Assume unity rms line current in each phase for a symmetrical 3-phase fault on the wye side of the transformer. Unity current flowing in each leg of the wye (Fig 1) is transformed to 0.577 current in each leg of the delta, due to the turns ratio of 1:1.73. The delta leg currents combine vectorially to form line currents having a value of unity. This is shown in the left-hand vector diagram of Fig 1. Selection of a three-phase fault as the most severe condition for phase relay coordination would thus appear justified.

However, Fig 2 shows a solid phase "b" to phase "c" fault. For equal positive and negative sequence impedances, which is usually assumed, the fault current for a phase-to-phase fault will be 87 percent of the value for a three-phase fault. The 0.87 fault currents in the line conductors will flow through two phases of the wye-connected windings in series. This must be balanced by corresponding currents, in the two respective delta-connected windings, equal to 0.87/1.73 (turns ratio) or 0.5 fault current. These two delta-winding currents will flow unmodified in two of the line wires as I_A and I_C. The third line wire will carry $I_B = 1.0$ fault current which is the vector sum of I_A and I_C as shown in the left-hand vector diagram of Fig 2. Thus 100 percent line current flows in the source side while only 87 percent line current flows in the fault side. The same relationship of line currents is shown in Fig 3. This diagrams a wye-delta transformer with a solid phase "b" to phase "c" fault on the delta side. The effect is thus present in both the delta-wye and wye-delta connection.

Typical Application

Phase relays (Fig 4) on breaker "A" will receive the same magnitude of current (100 percent) for a 3-phase fault and for a phase-to-phase fault. They will therefore measure identical elapsed times, to closing of trip contacts, for both types of faults. Phase relays on breaker "B," however, will take longer to close trip contacts on 87 percent fault current than on 100 percent 3-phase fault current. This has the effect of reducing the time interval of coordination if relays are coordinated on the basis of a 3-phase fault, and can result in incorrect relay operation. Therefore, in coordinating overcurrent relays through a wye-delta or delta-wye transformer, the established time interval of coordination should be provided between the point of 87 percent of 3-phase fault current for relays on the fault side and the point of 100 percent 3-phase fault current for relays on the source side (Fig 5).

Primary Network Operating Problems

A. M. MAC DONALD
Meter & Relay Division
and
A. W. FUNKHOUSER
Engineering Dept
Indianapolis Power & Light Co
Indianapolis, Ind.

REVERSED COMPENSATION has been found essential to prevent reactive power flow and regulator hunting under some load conditions on six small primary networks. Reverse power relays are needed to prevent feed-back into a transmission line that may be out at its source and to limit the feed into a substation that may be out of service. A network calculating board study is helpful in determining the best values to be used for each application.

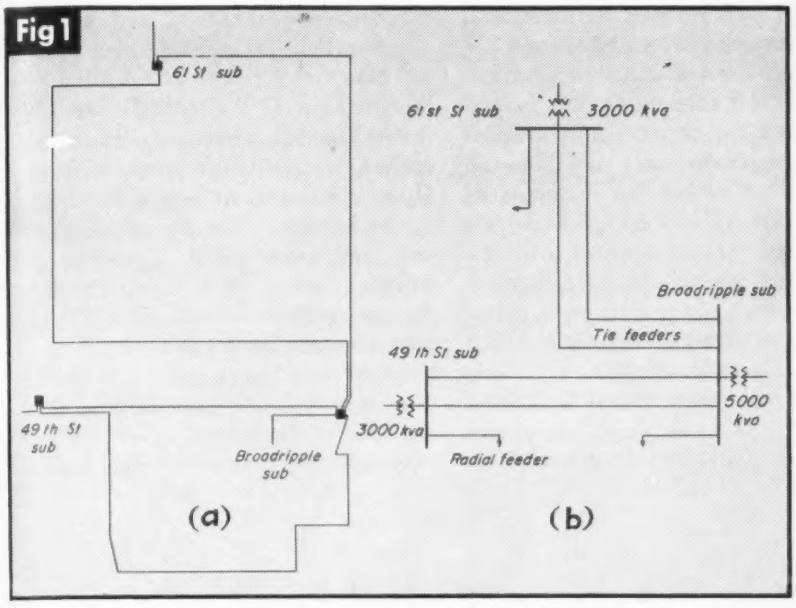
A typical small network grid is shown in Fig 1. Unit-type (3,000-kva transformer substations are tied to former radial feeders from the 5,000-kva bank at Broadripple substation. Step regulations with $1\frac{1}{4}$ percent steps at 49th St and 61st St must operate in parallel with step-type regulators having $\frac{5}{32}$ percent steps at Broadripple.

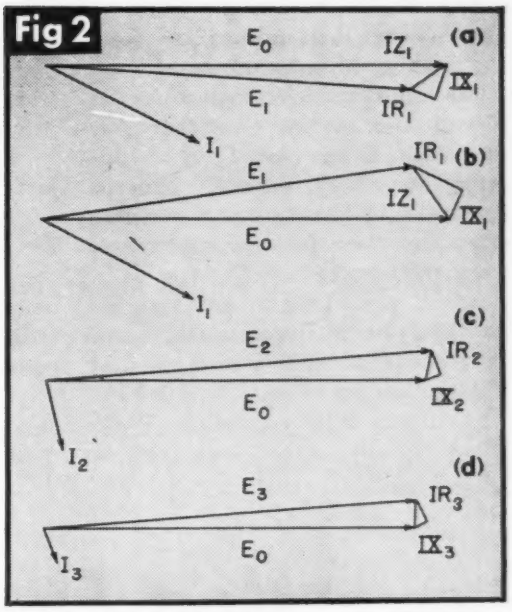
It was found early in the operation with this type of connection that there is not enough circulating current to cause trouble, with the usual loads on distribution. However, prior to the installation of step-type bus regulators at the radial substations, there was found to be a reactive flow between the unit substation and the radial substation during light load conditions. A trial was made with compensation removed at the unit substation to maintain a flat voltage, but the reactive flow still occurred with light load.

Reversal of the reactance connections in the compensators at the substations corrected this condition. This is now the practice on all compensators connected in the networks. For example, in the substations shown in Fig 1, resistance values are now set 13, 22 and 14 respectively at the 61st St, Broadripple and 49th St substations. Reactance is set minus 3 on all the compensators.

Final compensator settings are best determined by actual tests under operating conditions in the field. Initial theoretical calculations are subject to unforeseen variables in the characteristics of each feeder. Mathematically, there are two relationships that must be solved simultaneously to determine the value of reactance setting.

Final regulation is such that when the kilowatt load increases, the "R" component calls for a larger raise in voltage than would normally be the case. Increase of the reactive current through the compensator tends to lower the primary voltage, since the reversed reactance component results in an increase of voltage across the regulator voltage relay. The regulator thus, in effect, tries to shirk taking more current of low power factor





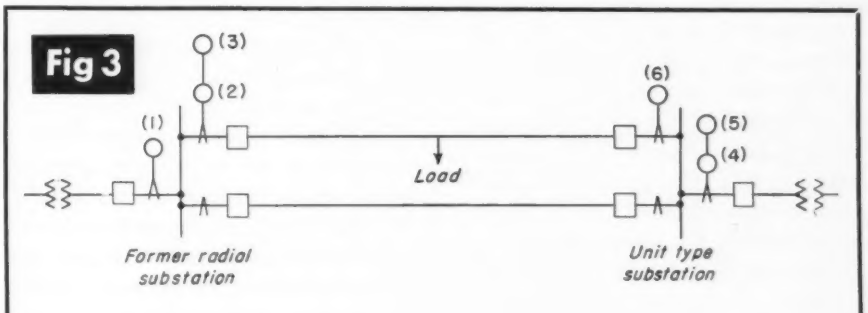
TYPICAL SMALL NETWORK GRID formed by connection of unit-type substations to the outer ends of radial feeders from an older substation (Fig 1). Vector diagrams that show the effect of reversed reactance used for control of primary network regulating equipment are shown in Fig 2 at right. Voltages and drops impressed on the primary relay circuit are: E_0 from potential transformer on load side of regulator. $E_1E_2E_3$ resultant voltages with compensator components added. Sketch (a) shows vectors when the compensator is set in the usual manner. The voltage IZ_1 induced in the line-drop compensator causes a resultant voltage E_1 at the terminals of the primary relay for the condition of heavy load current I_1 (of high power factor). The relay thus makes the regulator boost and there results a higher voltage corresponding with E_0 at the regulator in order to maintain the constant voltage corresponding with E_1 at the load end of the feeder . . . Sketches (b), (c), and (d) illustrate the condition with the resistance component increased and the reactance reversed. In (b) the vector I_1, represents heavy load current through the regulating equipment. A momentary increase of I_1 results in a momentary decrease of E_1. The relay then causes boosting and E_0 is increased until E_1 regains its normal value. For the same I_1, E_1 is the same magnitude in parts (a) & (b) . . . Sketch (c) I_2 is the vector sum of the current (light load) I_1 and a circulating current I_0 that tends to increase voltage E_0. E_2 increases and the regulating equipment bucks. The circulating current I_0 is thus cancelled and the resulting current is I_2 whereupon E_2 decreases to its original value as shown in (d). This indicates that the voltage at the load is maintained constant

with the reversed reactance producing a buck. This is illustrated in the vector diagram, Fig 2.

Overcurrent relays on the networks are set high enough to carry all load of the tie to the connected substation. A value of 250 percent of total load is practical. No ground relays are used on the feeders. These have solidly grounded neutrals at the substations and are multi-grounded at all distribution transformers.

With the present six small network grids, it is necessary to prevent power flow that would let the smaller substations try to carry the entire load of the larger substation. Reverse power voltage-restraining relays are used to limit the feed from a tie circuit into the larger substation. There is a 2- to 3-sec time-relay to let the radial circuit relay operate if needed. Under light load conditions it is possible to take the large substation out of service and carry all of the load from the smaller substations, without changes in the relay settings.

Reverse power relays of the network protector type controlling low-energy over-current relays are used on the transformer bank circuit breakers of the unit-type substations. They prevent feed-back into a transmission line that may be faulted, and reclose upon restoration of the proper transmission voltage. Typical relaying for a former radial substation tied to a unit-type substation is shown in Fig 3.



Location	Pick-up	Cycles
(1) Bank Overcurrent	2,880 amp	130 at 11,520 amp
(2) Feeder Overcurrent	480 amp	48 at 2,000 amp
(3) Reverse Power	160 amp	3 sec time delay
(4) Bus Overcurrent	960 amp	60 at 2,880 amp
(5) Reverse Power	240–680 amp	24 at 1,440 amp
(6) Feeder Overcurrent	500 amp	36 at 2,000 amp

TYPICAL NETWORK relaying with former radial substation and unit type substation

Must Electric Rates Go Up?

LESTER S. READY • Consulting Engineer, San Francisco, Calif.

AS WE LOOK into the future we can see that utilities are faced with conditions which will not permit further rate reductions as measured in money. Conditions may necessitate an increase. Costs of operating labor may increase. Material prices for maintenance and operation may also rise. New construction is relatively expensive. The cost is at least 50 percent higher now than immediately before the war. The cost of a steam plant used to be figured at $100 or less per kilowatt. Utilities will be fortunate if the cost of new steam plant capacity can be kept down to $150 per kilowatt. Hydro costs have increased at least in the same proportion. This increase also applies to the cost of transmission and distribution systems.

Rate increases may be necessary to meet higher costs of labor and material, says rate expert

Rates Based on Original Cost

Rates have been based largely on a consideration of the original costs of the plant utilized. As the relatively lower costs of existing construction are augmented by the higher costs of new construction and of replacements, concurrently higher costs of service may be expected. An offsetting factor is the reduction that has taken place in federal taxes. There are two other major factors present which tend to offset higher costs of utility service. One is the low interest rates which have of recent years been available for the financing of construction. The other is the rate of return. A fair rate of return in 1925 was 8 percent; bond money to private utilities then costing an average of 6 percent or better. Under present conditions, with bond money costing 3 percent or less, and preferred stock selling on less than a 4-percent basis, we may experience a fair return of around 5 percent on the investment. Some reports are that the job costs nearly twice as much as it would have in 1939 and 1940.

Publicly owned utilities have not been affected directly by the federal income tax. But they are fully affected by the increased costs of labor and material. Whether the higher costs can be met without revising the rate for utility service upward will depend upon several things. There is not at present any indication of an increase in charges for purchased power. Normally all gross additions of plant must be provided for out of earnings. If funds from the profits of the past five or six years have been retained by the utility, it is in a fortunate position. If, on the other hand, the municipal government has made use of such excess earnings in keeping down taxes, a situation embarrassing to the utility may result. Capital expenditures will be much higher, especially in cases where load growth is rapid. Either the payments to the general fund of the municipality may have to be reduced, or the rates for utility service raised.

Unsound Federal Policy

In making future revisions in rates for domestic service, care should be taken that they are not influenced by the low rates of the federal agencies. Both TVA and Bonneville authorities proposed especially low rates for domestic service, specifying a five-mill rate per kilowatthour for a large block of energy between 200 and 1,100 kwhr per month, and a comparatively low rate for all the excess.

These low rates—extraordinarily low in light of the average family's inflated income—have encouraged the use of electricity for house heating. House heating is at best a low load-factor service. Already several private and some public agencies are worried about the possibility of further expansion of this load if these schedules are continued.

Experience has revealed that winter peak demands are growing and that the cost of such heating service exceeds the revenue obtainable for it.

California utilities have not been intrigued so far by these politically expedient rates. However, the federal authority is pushing its ideas and expanding its system. Unless it does an "about face," the utilities may soon be faced with the necessity of combating the government's unsound program of domestic rates.

Psychology In Rate Changes

Already the bus and rail utilities, whose labor costs equal or exceed 50 percent of the total cost of doing business, have had to seek relief through increased rates. The public at present is not adverse to an increase in rates. The public realizes that increased wages cannot be paid without an increase in things which the wages enter into.

Whether it will be possible for the gas, electric and water utilities, to meet higher costs without raising rates is doubtful. Further rate reductions should be postponed at least until the effect of rising costs can be evaluated and the form of the rate structure can be determined on a sound basis.

If increases are necessary, they should be made promptly and prior to the temporary recession or settling down that may reasonably be expected to occur within the next two or three years.

Adaption of paper presented by the late Lester S. Ready before the California Municipal Utilities Association. Mr. Ready was formerly chief engineer of the California Railroad Commission

Automatic Sectionalizing Applied to 4-Kv

H. C. DENISON • Distribution Engineering Dept, Oklahoma Gas & Electric Co, Oklahoma City, Okla.

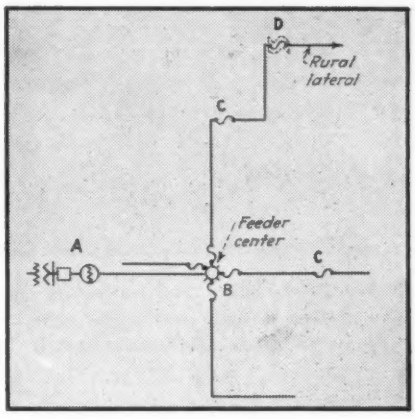
Electronic timer control aids quick action . . . Close coordination of time-current characteristics essential

RELAYING SCHEMES for instantaneous initial tripping of all faults, with subsequent overcurrent time-delay tripping for persistent faults, have resulted in considerable improvement in circuit reliability; particularly on sub-transmission systems. A recent elaboration of this relaying principle in our company was the combination of automatic sectionalizing of circuit branches with the instantaneous initial tripping and its application to 4,160-volt urban distribution feeders.

This application was given impetus by our development of an electronic timer control. It holds the instantaneous relays out of service, long enough to allow for the operation of the time-delay relays or for sectionalizing fuses to clear persistent faults. It then returns them to service automatically.

In this relaying application, all temporary faults on the feeder, except on rural laterals, are cleared with only a tripout of the feeder circuit breaker. When persistent faults occur beyond the feeder center, the outage is confined to one feeder branch or section of it, by the operation of the sectionalizing fuses. This occurs after the initial feeder tripout, without disturbing the remainder of the feeder. Thus the time-delay relays lock open the feeder circuit breaker only when persistent faults occur between the substation and the feeder center.

The accompanying diagram illustrates a typical application of this relaying system to one of our 300-amp, 4,160-volt distribution feeders. This is a conventional radial type feeder. It has branch feeder sectionalizing fuses at the feeder center and auxiliary sectionalizing and rural lateral fuses on the longer branches as necessary. In order to prevent damage to the sectionalizing fuses during the initial feeder tripout, the fuse links were selected with time-current characteristics. These permit them to carry the maximum available fault currents a longer time than required for instantaneous tripping of the feeder circuit breaker.



TYPICAL ARRANGEMENT of 4,160-volt feeder for instantaneous initial tripping and automatic sectionalizing

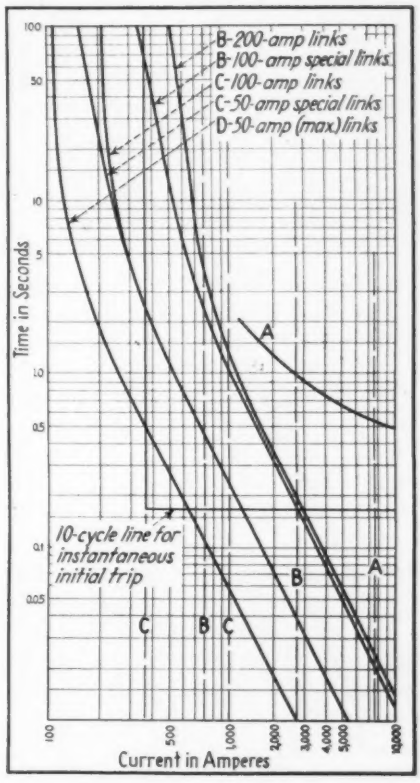
A—Oil circuit breaker with instantaneous relays set for 350 amp pick-up and time-delay phase relays set for 900 amp pick-up, and 1½ time lever

B—Branch feeder sectionalizing fuses, single shot, with 200-amp or 100-amp special coordinating links

C—Auxiliary sectionalizing fuses, single shot, with 100-amp or 50-amp special coordinating links

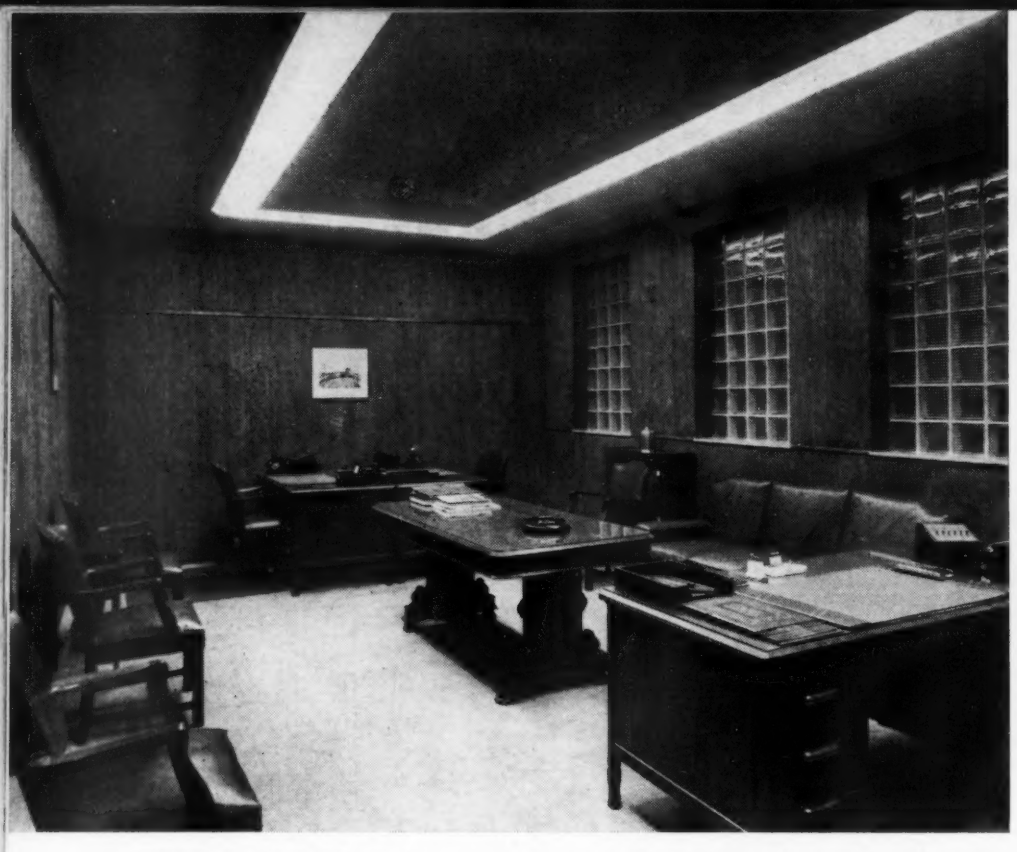
D—Single or three-shot fuses at end of instantaneous relay protection zone

Time-delay relays are set to operate in a larger time than required to clear the branch sectionalizing fuses and to clear all persistent faults as far out as the feeder center. The instantaneous relays, however, are set as low as practicable in order to clear all temporary faults in the main feeder area. Rural lateral fuses are used to clear all faults beyond the range of these relays. On short feeder branches, the branch sectionalizing fuses only are sufficient fault protection. Auxiliary sectionalizing fuses and rural lateral fuses are added where required on the longer branches.



TIME - CURRENT characteristic curves for fuse and relay coordination study, with references to the one-line diagram. Vertical dash lines show maximum fault current at substation (A) and maximum and minimum fault currents at the sectionalizing fuse zones. The minimum value at point "C" is the pick-up setting for instantaneous relays

The relation of the time-current characteristics for the relay settings and the fuse links used in the various sectionalizing fuses for this typical feeder are illustrated in the curves. Characteristics of the maximum practicable fuse link sizes available form a definite limitation on the arrangement of the feeder and its sectionalizing fuses. But this scheme can be adapted successfully to a large portion of our urban distribution feeders.



1 EXECUTIVE OFFICE. Twelve egg-crate-louver, troffer fixtures, each containing three 40-watt, 3,500-deg white, fluorescent lamps, are recessed in the 9-ft 6-in. flat-white ceiling. Walls are walnut veneer. Maintained intensity is 60 ft-c. Connected load is 1.8 kw

2 SALES AND SHOW ROOM, A. Fourteen semi-indirect, glass-panel fixtures each with four 40-watt, 3,500-

PLANNED LIGHTING

4 DRAFTING ROOM and salesmen's office. Seven semi-indirect, glass-panel fixtures, each with four 40-watt lamps, maintain 75 ft-c

5 GENERAL OFFICE. Fixtures and mounting are same as in drafting room and salesmen's office. Wider spacing maintains 65 ft-c

6 BUILDING FRONT. Fifteen 200-watt incandescent lamps in goose-neck reflectors light the building front and silhouette the name of the firm

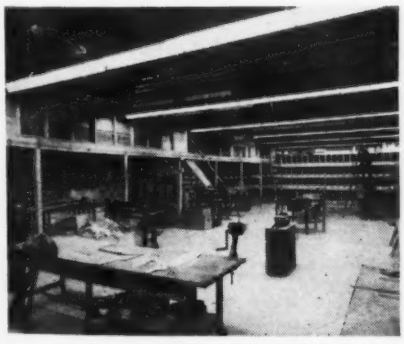
DAVE CHITTOCK
Cleveland Electric Illuminating Co

OWNER, architect, contractor, fixture suppliers and power company are equally—and happily—responsible for the outstanding modern lighting installation in the building of the Home and Industrial Heating Co in Cleveland. Each party contributed to the end result—highly satisfactory seeing conditions for the various functions in the building. Light intensities range up to 75 ft-c. The load, exclusive of miscellaneous lighting in washrooms and other non-producing areas, amounts to 28.7 kw. Sales and showroom *A* has 48 ft-c using 2.8 kw. Twelve 300-w reflector lamps in adjustable sockets are mounted on window header. Electric kitchen has two 22-ft lines of cold-cathode tubing, cove mounted. Fixtures in drafting room are mounted 1 ft below ceiling. In service department, 40-w lamps are mounted 10 ft above floor, ceiling height 16 ft.

deg-white fluorescent lamps, are mounted 2 ft below the 11-ft ceiling. Walls and ceiling are light green

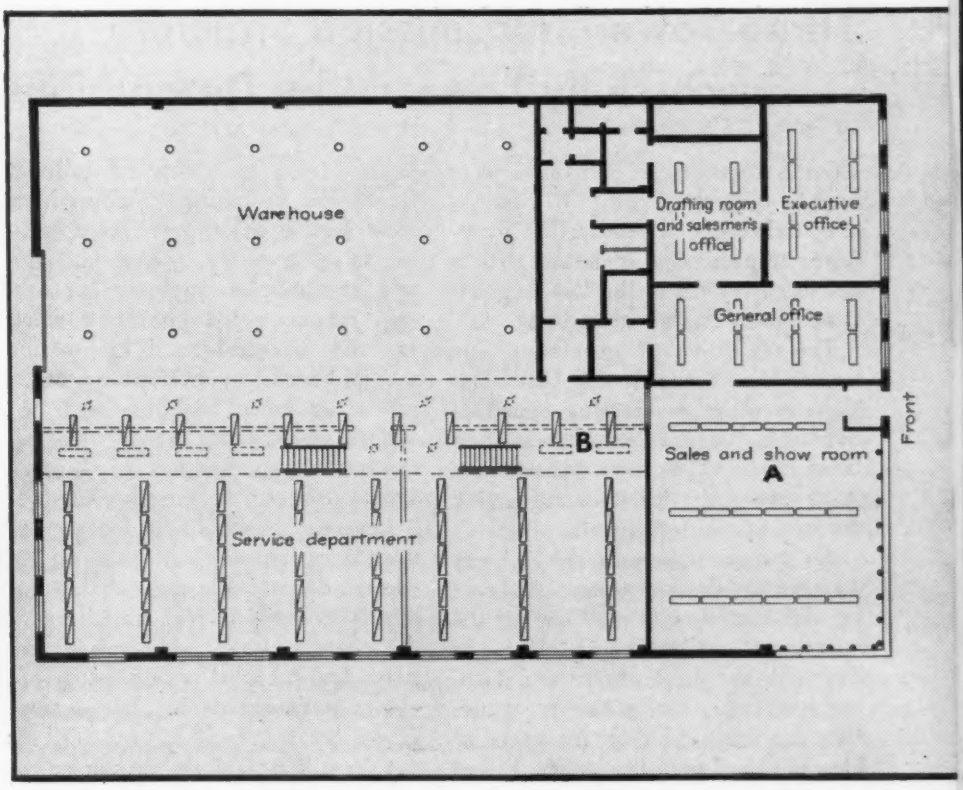
3 SALES AND SHOW ROOM, B. Original plan was modified to extend show room into area B. Sixteen bare-lamp troffer fixtures each with two 40-watt fluorescents are recessed in the 7-ft 6-in. ceiling. Maintained intensity is 60 ft-c and load is 1.6 kw

Results from Cooperation



7 SERVICE DEPARTMENT. Thirty-five direct, industrial type fixtures, maintain intensity at 47 ft-c

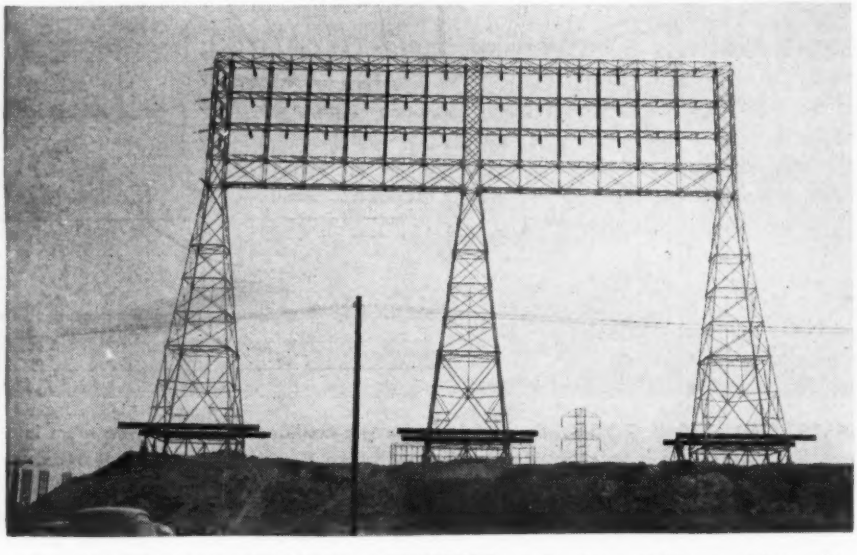
8 WAREHOUSE. Twelve RLM open reflectors with 500-watt incandescent lamps provide 20 ft-c



ORIGINAL PLAN of building for sales and service of heating equipment. Plan was somewhat revised as construction proceeded

HOW

DESIGN • CONSTRUCT • OPERATE • MAINTAIN



THREE-TOWER TRANSMISSION STRUCTURE of Southern California Edison Co affected by a settling operation, showing counterweight fill. Dynamite used to even the settling. I-beams attached to tower bases are for final jacking and leveling

Three-Tower Transmission Structure Successfully Lowered by Detonations

SMALL CHARGES of dynamite were used to even the settling of a Southern California Edison Co three-tower transmission structure near a new highway fill in the Los Angeles-Long Beach Harbor area.

The 66,000-volt transmission line towers were lowered in a California highway division freeway construction job. There sand-drains had been used to remove sub-surface water under the fill, thus subjecting the structure to settlement.

An agreement between the highway division and the utility stipulated that the differential settlement during the operation must be limited to 3 in. in line with the three towers and 1 in. transverse to the tower structure. Leveling was to be done by means of base plates of variable length, bolted above the new ground line after final settlement.

When it became apparent that, because of the proximity of railroad tracks and an existing roadway, the three legs of the tower were not going to settle evenly, Jordon Q. Lummis, transmission engineer for Edison, recommended placing a small explosive charge beneath each of the east and center tower footings, where rate of settlement had decreased.

Eight 4-in. pipes were jetted beneath the four footings of the two towers. About 5 ft beneath each 4x4-ft concrete spread tower footing dynamite was placed, $\frac{7}{8}$ of a stick of 40-percent dynamite in each charge under the end tower, $\frac{5}{8}$ of a stick under the center. Pipes were raised and partially backfilled with sand before charges were exploded. Charges were placed below ground water level.

Except for a slight movement of the insulators no vibration in the tower structure was visible.

Before the explosive was placed, the east tower had settled about 0.35 ft, the center about 0.45 ft and the west about 0.60 ft. The west tower was continuing to settle about 0.02 ft per day, while the other two were practically stationary.

Immediately following the detonation, measurements showed the east tower had settled 0.02 ft, the center tower 0.01 ft and the west tower not at all. Two days later the east tower had settled 0.21 ft, the center 0.15 ft, the west, 0.07 ft. In short, the differential settlement between the east and west towers had been reduced by about 0.13 ft.

Two subsequent charges were detonated after further surcharge embankment had been added to within 4 ft of the planned height and further unequal settlement had exceeded the 3-in. limit. Additional settlement of towers by the method, however, proved to be progressively less effective, probably due to the inability to jet additional material from beneath the footings.

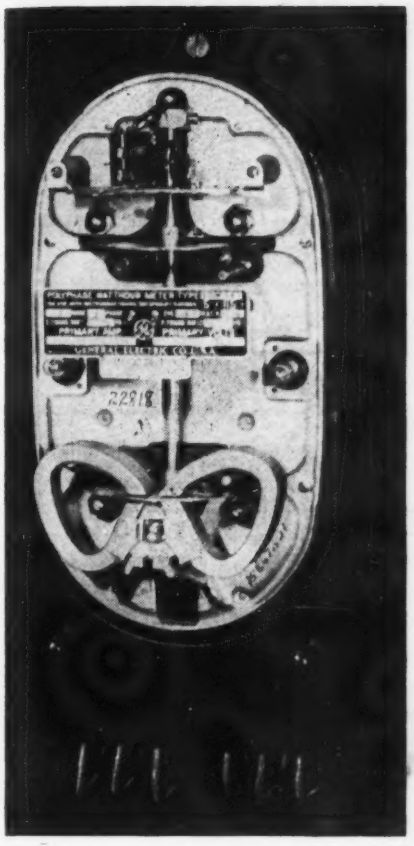
S. V. Cortelyou, district engineer, F. B. Cressy, district construction engineer, and W. D. Eaton, resident engineer, were in charge of the project for the state.

•

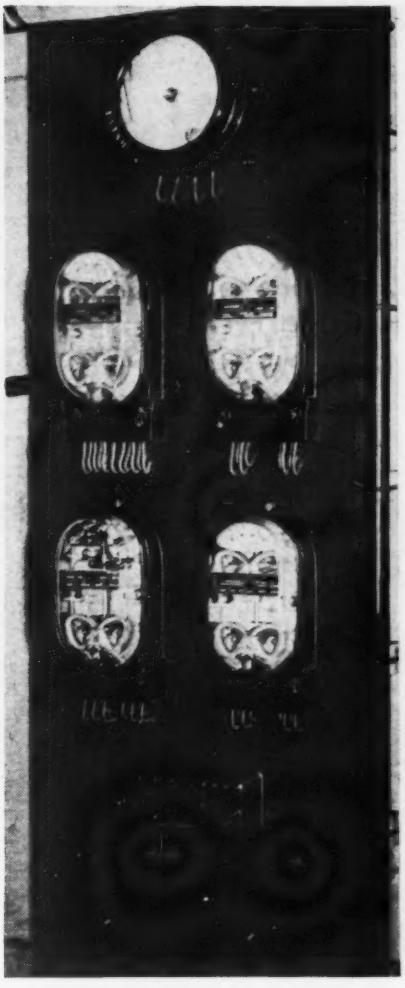
Relay Solves Problem Of Reactive Register

HARRY A. HARTWIG
Meter Engineer
Wisconsin Public Service Corp
Wausau, Wis.

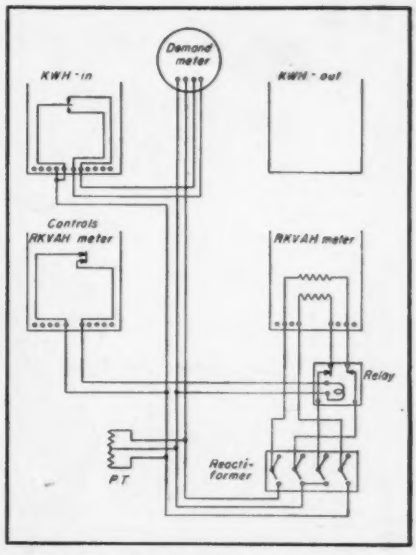
METERING of power and reactive flow on connections to industrial customers who also generate power for part of their requirements introduces a special problem of registering reactive during light load periods. On weekends and holidays the generating equipment is adequate for the load and some sur-



CONTROL RELAY for reactive flow built from standard meter, with overload relay contacts replacing the meter register to open potential coil



COMPLETE ASSEMBLY of .power and .reactive meters for .two-way flow registration. .Special .reactive control lower left



SIMPLIFIED DIAGRAM of .connections for registration control of reactive flow by meter used as relay

plus power may flow out to the utility supply lines.

Because the reactive meter does not have a sense of direction of power flow, a simple ratchet can not be used as in the power meter. A relay, which we have built and used successfully, controls the reactive meter to register only when power is flowing into the industrial plant.

A General Electric polyphase meter was rebuilt with overload relay contacts and brackets replacing the register. The closing contact is fastened on the shaft, limiting the distance of rotation to one-eighth revolution. The upper magnet was removed, making the meter more sensitive to power reversals. Another relay was used for disconnecting the potential on the reactive meter, as shown in the accompanying simplified diagram.

When power is flowing in, the contacts on the control meter are open, the relay then is normally closed and reactive hours are registered. When the power is flowing out, the contacts on the control meter close, the relay is energized, thereby opening the potential on the reactive meter and no reactive hours are registered.

• • •

Safeguarding Sleet Thawing Operations

H. R. TOMLINSON
New England Power Service Co
Boston, Mass.

TO MINIMIZE the risks recognized in sleet thawing on transmission lines, the entire procedure has been reviewed by the New England Power System and the following steps taken: (1) a permanent parkway cable was installed underground between the indoor generator switching equipment and the overhead line terminals to reduce jumper cable length to the shortest possible amount; and (2) weatherproof steel boxes were installed at the line terminals to inclose all live parts necessary for the jumper cable's contact with the permanent underground cable and to interlock access to these parts with the generator switching equipment. The connection boxes have hinged front doors which, when closed completely, inclose all exposed live parts.

Sleet thawing on the 66-kv lines by the short-circuit method generally uses a 13-kv generator to supply approximately 350 amp of heating current to the circuit, which has been shorted at the far terminus. The generator is directly connected to the transmission circuit during thawing operations by portable jumper cables attached with removable switch poles to the overhead line by specially assigned yard crews. Formerly these jumper cables had to be long enough to extend from the generator switching equipment to the most remote 66-kv line in the yard. Handling was cumbrous and some peril to the gene-

the *Load* outgrew the system

The Solution Was This

Voltage conditions became good all over the production area as soon as this G-E load-center unit relieved the overloaded, long secondary feeders.

Installed right at the center of the load area, it receives 13,200-volt power from the utility, distributes it at 480 volts to the motor loads through *short* secondary feeders.

The plant engineers like its compact, metal-enclosed construction that enabled them to install it in unused space between columns, right on the factory floor. They like the easy-to-operate drawout breakers, too, which have adequate interrupting capacity to properly safeguard production against the heavy losses caused by power interruptions.

F. W. Hardenstine, the Chief Electrician, says, "The unit substation gives us power when we want it, where we want it. Installing it was merely a matter of moving it off the freight car, setting it in place and connecting the cables."

Your G-E sales representative will gladly help you with your next plant distribution problem. His recommendations will be based on General Electric experience in equipping thousands of load-center power systems that give their plants greater safety and operating economy at less cost.

These bulletins are available on request:

GEA-3592—"Load-center Unit Substations"

GEA-3758—"What Load-center Power Distribution Can Do For You"

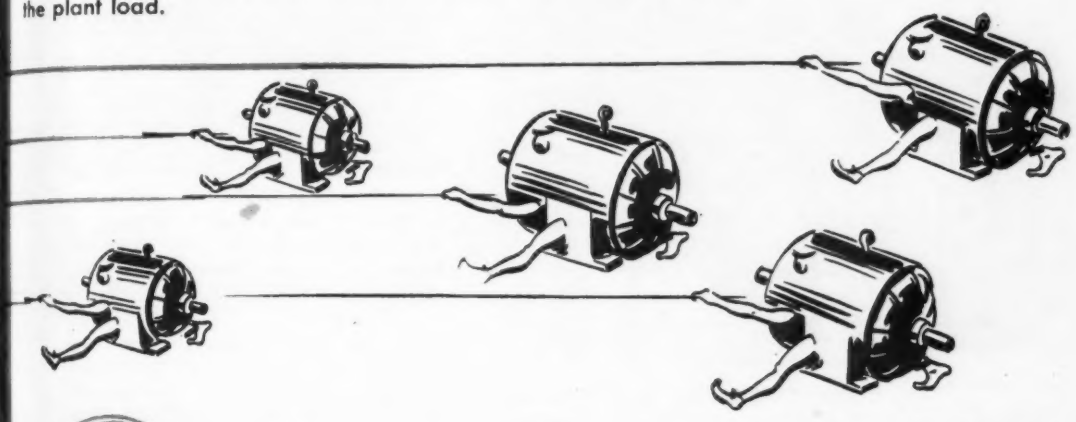
GEA-4085—Load-center Unit Substations For Semi-hazardous Locations

Ask your G-E sales representative, or write Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

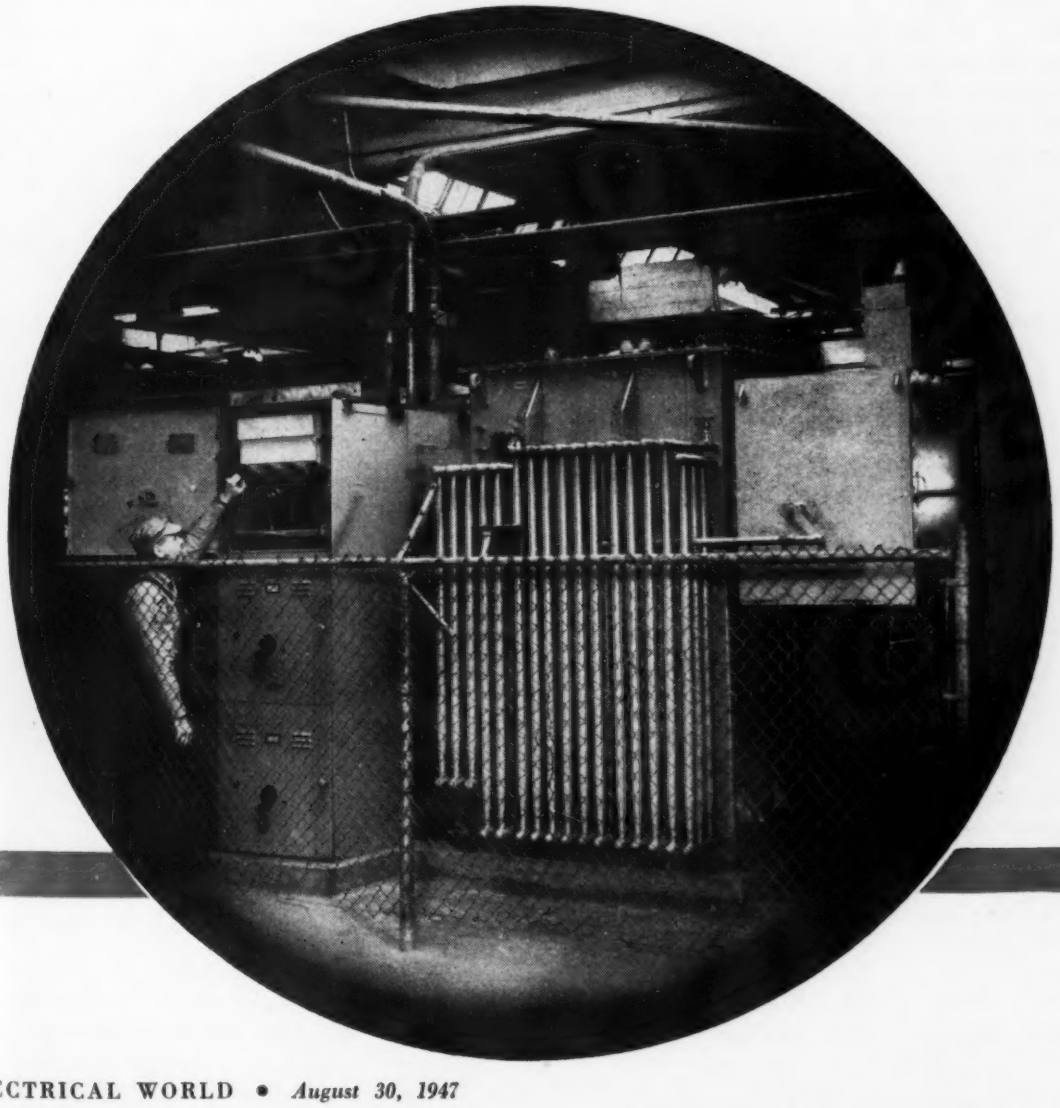
281-47

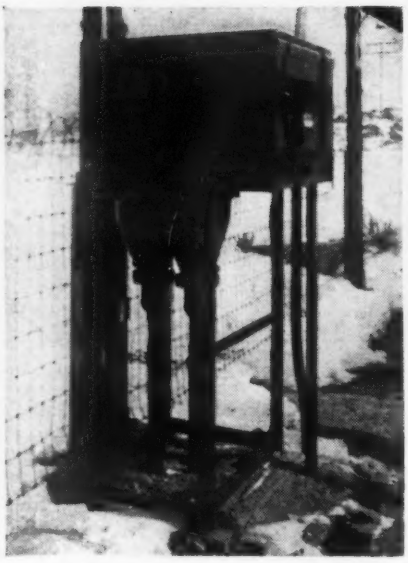
GENERAL ELECTRIC

The secondary circuits were badly overloaded in the plant of the Union Wire Rope Corporation, Kansas City, Mo. Voltage drops were severe—and costly. What's more, the fast-growing plant needed new equipment that was soon to add 600 HP to the plant load.

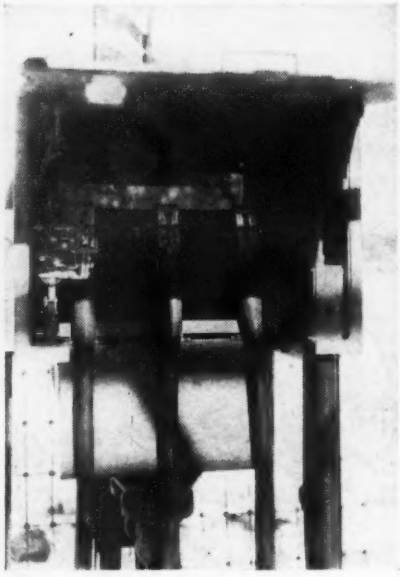


GE Load-center Unit!

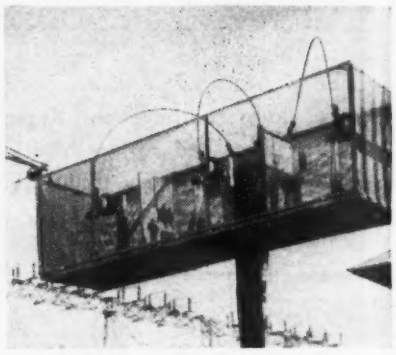




TERMINAL of permanent sleet-thawing circuit and connection box in 66-kv substation yard



CONNECTION BOX open with jumper cables in place for thawing. Solenoid-operated latches lock the doors in the closed position when generator breaker is closed and allow free access when breaker is opened. Auxiliary switches in the connection boxes complete interlocks with generator breaker control circuit, so that this breaker can be closed only when the doors of connection boxes are closed. If any connection box door is opened the generator breaker trips. Grounding contactors operated by opening the front hinged door remove any residual and provide safety ground



SAFETY GAP STRUCTURE at Millbury substation. Gaps protect the generating equipment from excessive voltage by discharging to ground any potentials impressed on the connected circuit. Gaps consist of brass electrodes in sealed glass housing. Discharge potential for the gaps applied to a 13-kv generator circuit is 20 rms kv to ground. The glass housings are shattered by the power-follow current if it exceeds 6,000 amp for a few cycles. Gap structure is inclosed by a protective screen to retain glass fragments otherwise hazardous to personnel and adjacent equipment

rator arose from the possibility of transmission voltage being impressed on the connected transmission circuit by another live sleet-laden line making accidental contact with it at a point of crossing.

Under the new set-up, jumper cables can be connected only to a de-energized and grounded supply circuit. A complete and reliable interlock exists between the station operator and the yard crew. It is anticipated that thawing operations have now been raised to the same high safety level of other practices on the system.

• • •

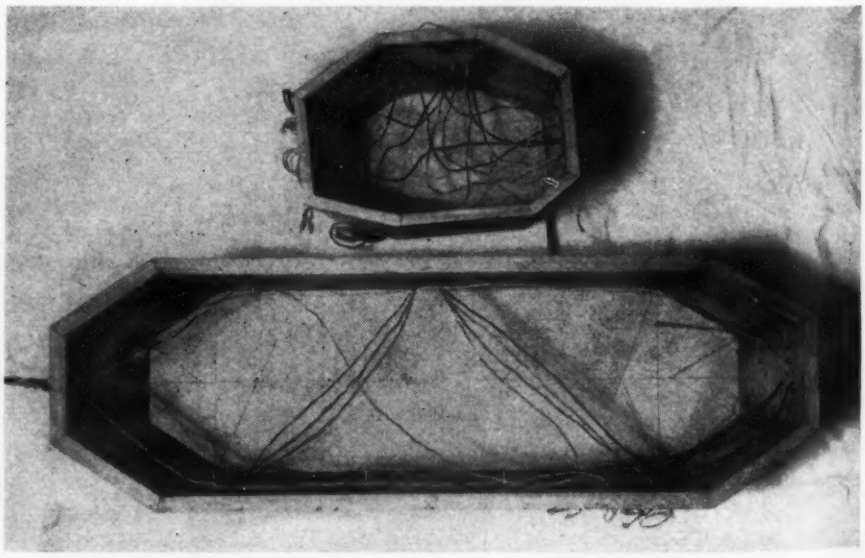
Models Used in Manhole Planning

P. A. BURVANT
Assistant Operating Engineer
New Orleans Public Service, Inc

REBUILDING or adding to duct systems and enlargement of manholes offer especially complex drawing problems when cables must be traced through the several views of sidewalls. Models built with wood panels have been found very helpful in tracing and visualizing the cable entrances and routing.

The accompanying illustration shows two scale model manholes (1 in. = 1 ft). The small model at top shows a rebuilt manhole before rearrangement of the cables, while the lower model shows three smaller manholes after consolidation into one, and the final arrangement of the cables.

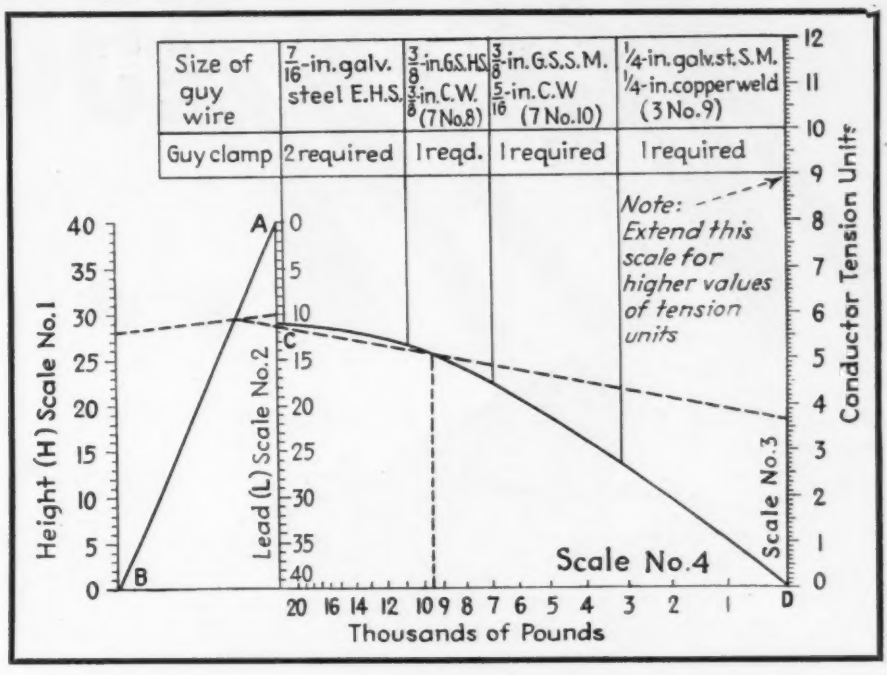
Twisted pairs of No. 19 communication cable with colored braiding were taken from a piece of scrap, and the color code simplified the layout job considerably. Nails are used for racking. The models can be used also by the splicing crews in the field, as a simple guide for following out the planned racking of the cables.



WOOD MANHOLE MODELS to scale 1 in. equals 1 ft help in rearranging complicated cable runs. Colored braid communication wire is racked on nails

Chart for Selection of Guy Strand

H. F. OSTMAN
System Standards Engineer
Union Electric Co of Missouri
St. Louis, Missouri



CONDUCTOR TENSION UNITS are used in the accompanying chart to determine guy and anchor data required. These units are the resultant forces under heavy loading, in 1,000 lb, for a given conductor and line angle incorporating the several factors required by the NESC for the construction grade involved. (60-deg units are used for straight dead-ends.)

Example

To determine the size guy strand for 3 No. 1/0 TBWP primary and 3 No. 2 TBWP secondary, urban grade C construction, 150-ft span, 15-deg angle, height guy 28 ft, lead guy 10 ft.

From Table I the conductor tension units are 0.71 and 0.52 respectively.

For primary	3 × 0.71	2.13
For secondary	3 × 0.52	1.56
Total conductor tension units		3.69

Lay a straight edge on the chart passing through 28 on height scale (1) and 10 on lead scale (2), marking its intersection on line AB. Then lay straight edge to pass through this intersection and point 3.69 conductor tension units on scale (3). Read size guy strand on line CD.

Project from intersection to scale (4) to read anchor loading in thousands of pounds and select anchor to be used.

TABLE I—Conductor Tension Units—Urban Construction (Under 175-ft space)

Line Angle, deg	No. 6 Bare No. 6 W.P.		No. 4 Bare No. 4 W.P.		No. 2 Bare No. 2 W.P.		No. 1/0 Bare No. 1/0 W.P.		No. 2/0 Bare No. 2/0 W.P.		No. 4/0 Bare No. 4/0 W.P.	
	C*	B*	C	B	C	B	C	B	C	B	C	
5	0.21	0.27	0.24	0.32	0.29	0.38	0.37	0.48	0.37	0 48	0.38	0.50
10	0.26	0.34	0.31	0.41	0.41	0.53	0.54	0.71	0.57	0.74	0.58	0.76
15	0.31	0.39	0.39	0.51	0.52	0.68	0.71	0.94	0.76	1.02	0.78	1.02
20	0.36	0.47	0.46	0.61	0.64	0.84	0.90	1.18	0.96	1.26	0.97	1.28
25	0.40	0.53	0.53	0.70	0.75	0.98	1.07	1.41	1.15	1.51	1.16	1.53
30	0.45	0.59	0.61	0.80	0.87	1.05	1.26	1.65	1.35	1.78	1.36	1.79
35	0.50	0.64	0.68	0.89	0.98	1.29	1.42	1.87	1.53	2.01	1.54	2.02
40	0.54	0.71	0 75	0.98	1.09	1.44	1.59	2.09	1.71	2.24	1.72	2.26
45	0.59	0.77	0.82	1.08	1.21	1.59	1.77	2.33	1.90	2.50	1.91	2.52
50	0.63	0.83	0.89	1.17	1.32	1.73	1.93	2.54	2.08	2.74	2.09	2.75
55	0.67	0.88	0.96	1.26	1.43	1.87	2.09	2.75	2.24	2.96	2.26	2.97
60	0.71	0.94	1.03	1.35	1.53	2.01	2.26	2.96	2.42	3.20	2.43	3.20

* Grades of construction in NESC

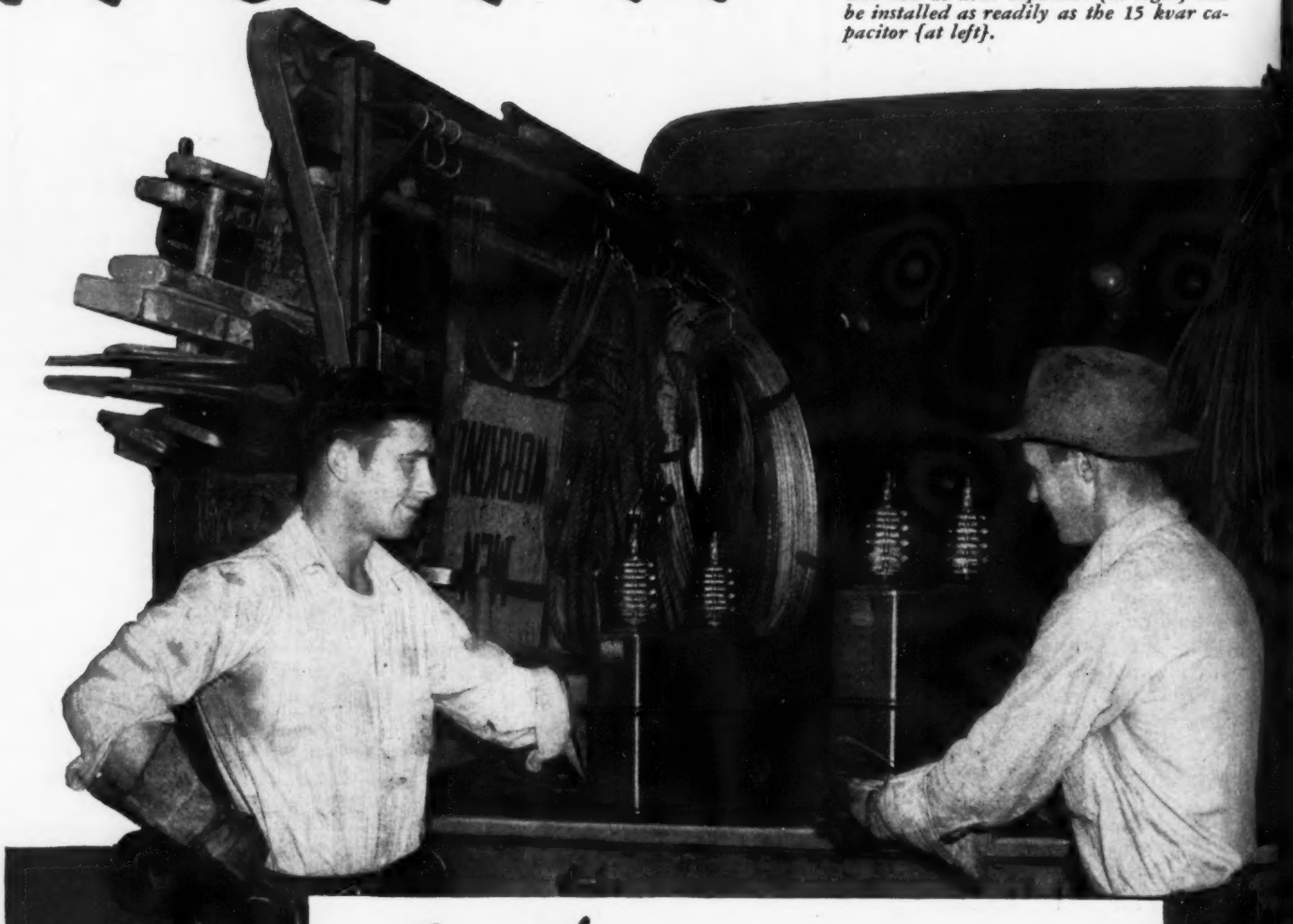
TABLE II—Conductor Tension Units—Long Span Construction (Over 175-ft space)

Line Angle, deg	No. 2 Bare No. 4 A.C.S.R. No. 8A-C.W. No. 6A-C.W.			No. 1/0 Bare No. 2 A.C.S.R. No. 4A-C.W.			No. 2/0 Bare No. 1/0 A.C.S.R.			80 Mcm A.C.S.R.			No. 2A-C.W.			No. 4/0 Bare No. 3/0 A.C.S.R.			No. 4/0 A.C.S.R.		
	N*	C*	B*	N	C	B	N	C	B	N	C	B	N	C	B	N	C	B	N	C	B
5	0.30	0.49	0.64	0.38	0.59	0.77	0.43	0.66	0.87	0.45	0.68	0.90	0.49	0.72	0.95	0.58	0.85	1.11	0.65	0.93	1.22
10	0.43	0.64	0.84	0.58	0.82	1.08	0.67	0.94	1.23	0.73	0.99	1.30	0.80	1.07	1.41	0.96	1.28	1.68	1.09	1.43	1.88
15	0.57	0.79	1.04	0.79	1.05	1.38	0.91	1.21	1.59	1.00	1.30	1.71	1.10	1.42	1.87	1.34	1.71	2.24	1.53	1.92	2.53
20	0.70	0.94	1.24	0.99	1.28	1.69	1.16	1.49	1.96	1.27	1.60	2.11	1.41	1.77	2.32	1.72	2.14	2.81	1.97	2.43	3.19
25	0.83	1.09	1.43	1.19	1.51	1.98	1.38	1.74	2.30	1.53	1.90	2.50	1.70	2.10	2.76	2.08	2.55	3.35	2.38	2.90	3.82
30	0.96	1.24	1.63	1.40	1.74	2.29	1.63	2.05	2.66	1.80	2.20	2.90	2.01	2.45	3.22	2.47	2.98	3.93	2.83	3.41	4.49
35	1.09	1.38	1.82	1.58	1.96	2.57	1.85	2.27	2.98	2.04	2.48	3.27	2.29	2.77	3.64	2.81	3.38	4.45	3.24	3.87	5.10
40	1.21	1.52	1.99	1.77	2.16	2.85	2.07	2.52	3.31	2.29	2.77	3.64	2.57	3.08	4.05	3.16	3.77	4.96	3.64	4.32	5.69
45	1.34	1.67	2.19	1.97	2.38	3.14	2.31	2.79	3.67	2.55	3.06	4.03	2.67	3.42	4.50	3.53	4.18	5.50	4.06	4.80	6.33
50	1.46	1.80	2.36	2.16	2.60	3.42	2.53	3.04	4.00	2.81	3.35	4.40	3.15	3.73	4.91	3.87	4.58	6.03	4.46	5.26	6.93
55	1.58	1.93	2.53	2.33	2.80	3.68	2.73	3.26	4.28	3.03	3.60	4.74	3.41	4.03	5.30	4.19	4.94	6.50	4.84	5.68	7.46
60	1.69	2.06	2.71	2.51	3.00	3.94	2.95	3.50	4.60	3.28	3.88	5.10	3.68	4.35	5.71	4.54	5.33	7.00	5.23	6.13	8.06

* Grades of construction in NESC

NOW... 25 KVAR IN

The new 25 kvar capacitor {at right} can be installed as readily as the 15 kvar capacitor {at left}.



Another GE First

1930—G.E. introduced thin kraft paper

1930—G.E. introduced 10 kvar, oil-filled, individual unit

1931—G.E. introduced *Pyranol

1932—G.E. introduced 15 kvar Pyranol individual unit

1937—G.E. introduced resistance-welded, drawn-steel cases

1947—G.E. introduced glass bushings

AND NOW—G.E. introduces a 25 kvar pole-type unit

ONE CAPACITOR UNIT

FOR POLE MOUNTING

General Electric announces a 25-kvar Pyranol capacitor that can be mounted in standard hangers

SMALL INCREASE IN SIZE OVER 15-KVAR UNIT These new capacitors, with 67 per cent more capacity, take approximately the same mounting space as 15-kvar units. Length remains the same. Width is increased only one inch. Height increase, including bushings, ranges from 2¼ inches to 4¾ depending on voltage.

FEWER CONNECTIONS, BUSHINGS, HANGERS PER KVAR Installation costs come down with these new capacitors, for up to 225 kvar can be mounted on a single crossarm—whereas 180 is the limit with 15-kvar units. Fewer units per kvar means fewer bushings, connections, and less exposed surface, cutting maintenance costs, too. Standard hangers (Cat. No. 13F20 for 3 units, Cat. No. 13F1 for 1) can be used.

GLASS BUSHINGS, WELDED TO CASE, MEAN MAXIMUM DEPENDABILITY The newly announced glass bushing is used in these new capacitors—assuring a strong, hermetic seal which is permanent.

SERVICE-PROVED DESIGN These Pyranol* distribution capacitors are similar in all respects, to the hundreds of thousands of 10- and 15-kvar units which have been installed on power circuits throughout the country. Cases are of drawn steel, with one resistance welded seam.

SHORT SHIPMENT SCHEDULE These new capacitors are now available. A General Electric specialist will be glad to discuss their application to your system and Bulletin GEA-2561-F-1 is available from *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

CLASS ID—INDIVIDUAL POLE-TYPE UNITS—25-KVAR

For Nominal Circuit Voltage of	Capacitor Rating	Cat. No.	Net Wt. lb.	Approx. dimensions in inches		
				Length	Width	Over-all height (Incl. bushing)
2400 delta or 4160 gr-Y or ungr-Y.....	2400	13F138	70	13½	$5\frac{11}{16}$	21⅛
4160 delta, gr-Y, or ungr-Y.....	4160	13F140	70	13½	$5\frac{11}{16}$	21⅛
4800 delta or 8320 gr-Y.....	4800	13F148	71	13½	$5\frac{11}{16}$	$23\frac{9}{16}$
7200 delta or 12,470 gr-Y.....	7200	13F147	71	13½	$5\frac{11}{16}$	$23\frac{9}{16}$
7960 delta or 13,800 gr-Y.....	7960	13F141	72	13½	$5\frac{11}{16}$	$23\frac{9}{16}$

**Trade-mark Reg. U.S. Pat. Off.*

GENERAL ELECTRIC

407-124

How to Maintain Temperature Indicators For Generators and Large Transformers

IV*—KELVIN BRIDGE TYPE INSTRUMENT

W. F. DUNKLE
Supervisor of Electric Tests
Pennsylvania Power & Light Co, Hazleton, Pa.

A TESTING and maintenance procedure for resistance type temperature indicator and accessories manufactured by Leeds & Northrup Co.

1. General. By reference to the schematic diagram of the field temperature indicator it will be evident that for zero current through the galvanometer it will be balanced at zero.

The resistances B, B_1, S, S_1, A, and A_1 are selected so that the current in milliamperes to the galvanometer is proportional to the voltage across the pilot brushes of the field, and inversely proportional to the drop from the shunt which is the current. Thus $E_f/I_f = R_f$ or Ohms Law.

The various resistances are chosen so that their fixed values plus and minus part of S and S_1, keep the current ratios to the indicator equal to $E_f/I_f = R_f$.

The dial of the slide resistor is graduated in degrees instead of ohms and bears a definite relation to the exact resistance of the field and its temperature.

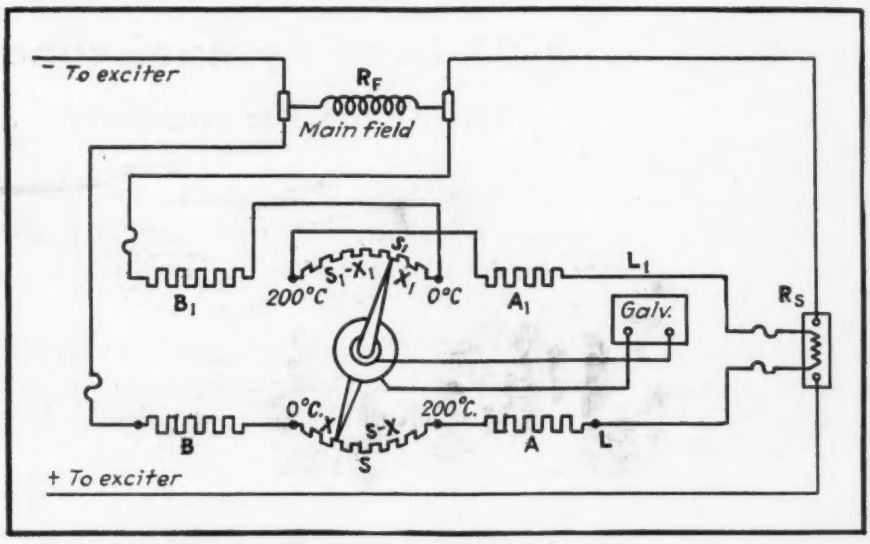
2. Measurement of Field Resistance. Generator field resistance is of low ohmic value and should be measured by two methods: (a) Volt-Ammeter and (b) Wheatstone Bridge.

Large errors result from slip ring contact resistance. The point of lead connection to the slip ring shall be burnished clean prior to clamping on the leads. In both methods contact resistance must be eliminated.

Errors of 1 percent are the equivalent of 2.6 deg. C. in temperature observation.

(a) Measurement by the Volt-Ammeter Method. Introduce an adjustable, low value of steady direct current through the field winding and simultaneously read the voltage drop at a separate point on the slip rings. Use only standardized, low reading instruments adjusted to zero accurately. Take an average reading at each of five values, between 30 and 10 percent of full scale. Immediately after reading the voltage, remove the voltage leads first, then gradually reduce and remove the test current. Do not under any condition break the current circuit before disconnecting the voltmeter. If you do not remove the voltmeter leads as prescribed, the field windings stored energy will produce an inductive kick on stoppage of current that will ruin the voltmeter.

(b) In the Wheatstone Bridge method the "Contact Plus Test Lead" resistance can be measured for deduction with fair accuracy, if three similar clamps are used. These are fastened identically, two to the first slip ring and the third to the second ring.



TEST CONNECTIONS for Kelvin bridge type temperature indicator with galvanometer, d.c. operated, and balancing resistance dial

3. Measurement of Bridge Resistance. At installation and when found necessary thereafter, test accurately and record the six (6) resistance values which make up the double bridge circuit as follows:

(a) Measure the field coil resistance R_f at a known temperature before installation or while the synchronous machine is down for overhauling. Use the voltage drop method as previously described, as well as the bridge method. At the same time, test millivolt drop or resistance R_s of the standard d.c. shunt by the same method. This value is R_s on the diagram.

(b) Read with a Wheatstone Bridge the four standard resistance values and the slides internal to the Kelvin Bridge designated as A, A_1, B, B_1, S and S_1 respectively as follows: Open the galvanometer switch, remove the four fuses from the instrument circuit. If the machine is running, remove the shunt secondary leads at shunt terminals and bolt these solidly together. Clean the slide wire with a dry clean cloth. Set the instrument dial exactly on full scale—200 deg. C. Measure accurately and record resistance values of A and A_1, leads L and L_1. With dial on zero, measure slide wires S and S_1 and high resistors B and B_1. Resistance of "A" plus lead plus fuse should equal 10 ohms plus or minus 1 percent. If these values differ by more than 1 percent, tighten thoroughly all terminals and recheck separately the resistance of leads and fuses.

(c) From measured test values calculate and check the manufacturer's standard resistance values as follows:

At 200 deg. C.

$$\frac{R_f}{R_s} = \frac{B_1 + S_1}{A_1 + L_1} = \frac{B + S}{A + L}$$

Likewise at 0 deg. C.

$$\frac{R_f}{R_s} = \frac{B_1}{S_1 + A_1 + L_1} = \frac{B}{S + A + L}$$

Likewise at X deg. C.

$$\frac{R_f}{R_s} = \frac{B_1 + X_1}{(S_1 - X_1) + A_1 + L_1} = \frac{B + X}{(S - X) + A + L}$$

where R_f = field resistance and R_s = shunt resistance.

4. Over-all Test. Use a standardized voltmeter and millivoltmeter applied at the pilot brushes and the d.c. shunt terminals respectively. Take the average of least six readings of current and voltage while the instrument readings remain constant. Calculate rotor resistance and temperature from this resistance data. Remove test instruments before reading the indicated temperature. Instrument accuracy should correspond to calculated value within 2 deg. C.

5. Adjustments. If values are found more than 1 percent (3 deg. C) in error, adjust standard resistance A and A_1 internal to the instrument, keeping the two balanced one with another.

* This series began in Electrical World, July 19, 1947, page 106.

REVERE detects *VIBRATION* at a distance

DO you know that vibration can be present in the tubes of a condenser, though not perceptible in the shell? Putting the palm of your hand on a condenser is not a good test for destructive vibration. The best test is one carried out in the Revere Research Laboratory in Rome, N. Y., which makes a microscopic examination of the metal as a part of its work in determining causes of tube failure. If vibration contributed to short life, this examination will show it. Vibration accelerates corrosion in several ways. The alternating stresses in time produce cracks across the grain of the metal, weakening it and giving corrosive fluids more points to attack. Vibration also breaks or disrupts or disturbs the thin film on the surface of the metal that protects it and helps reduce the rate of corrosive attack. Of course vibration is but one of a number of factors influencing the service life of condenser tubes, and so when tube life is questioned we always suggest that samples from failed tubes be sent to us. We may be able to help you, as we have others, with suggestions that should materially extend the period between re-tubings.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere

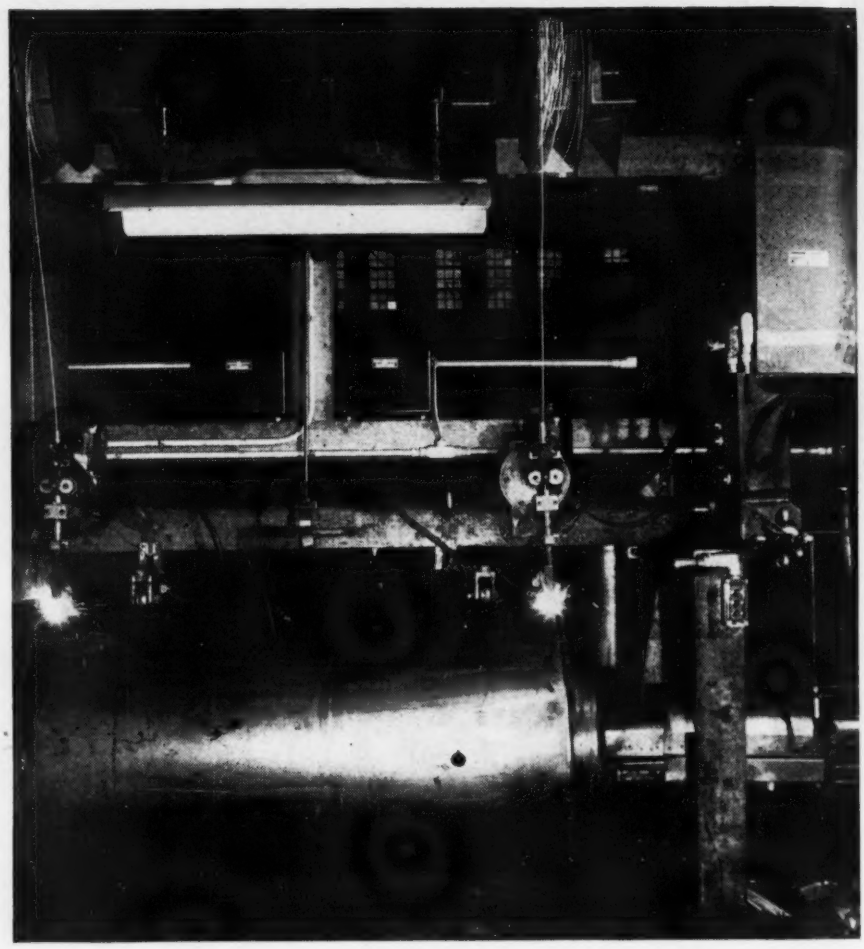
Arc Welding Fixture Speeds Tank Production

EVERY two minutes one gasoline storage tank 36 in. in diameter and 68 in. long is turned out at the Dayton Pump and Manufacturing Co, Dayton, Ohio. This is accomplished by an automatic arc welder using an ingenious welding fixture.

With tank casing and headers loaded in the fixture, a hydraulic ram presses the headers on the casing, providing a tight lap joint. The tank thus assembled is automatically centered in the fixture, and the entire mechanism rotated. A pushbutton starts both travel and welding.

Two welding heads are mounted so that both tank ends can be welded at once. The welding heads feed bare or lightly coated electrodes, and maintain a constant arc voltage by the use of thyratron control panels. Two operator's stations are provided, one on each side of the fixture. These are interconnected so that operation can be controlled from one or both stations. An air cylinder at the top of the fixture raises and lowers both welding heads at same time.

A limit switch is adjusted to stop operations after the weld is completed. Ground connections are made through two riding rolls which contact the casing a short distance from the arcs.



AUTOMATIC ARC WELDER with specially designed fixture assembles and welds one gasoline tank every two minutes

• • •

Average Properties of Silicone Rubber

Property	General Electric Co No. 12600	12601	12602	12603
Specific Gravity	1.75	2.04	1.40	1.50
Durometer, Shore A	40	60	70	80
Compression Set, % at 150 C	30	45	35	30
Tensile, psi	200	450	650	500
Elongation, %	225	150	110	100
Tear, lb./in	35	45	45	35
Dielectric Strength, s/s	300	260	385	400
vpm. at 25 C., s/t	325	285	450	450
Dielectric Strength, s/s	305	255	510	385
vpm. at 100 C., s/t	350	330	560	505
Dielectric Strength, s/s	400	335	620	505
vpm. at 150 C., s/t	345	345	680	505
Power Factor				
at 1 mc., dry	0.00075	0.00045	0.0030	0.0037
at 1 mc., after 3 days wet	0.0105	0.0175	0.0045	0.008
at 1 mc., after 7 days wet	0.0142	0.0182	0.0045	0.0082
at 1 mc., after 14 days wet	0.0160	0.0179	0.00475	0.0085
at 30 mc., dry	0.00310	High	0.00475	0.00735
Dielectric Constant				
at 1 mc., dry	3.8	7.4	3.25	3.45
at 1 mc., after 3 days wet	4.40	10.10	3.25	3.60
at 1 mc., after 7 days wet	4.45	11.30	3.25	3.60
at 1 mc., after 14 days wet	4.90	10.70	3.20	3.70
at 30 mc., dry	7.60	High	5.20	5.80
Loss Factor at 1 mc., dry	0.00235	0.00333	0.00975	0.01278
Volume Resistivity, megohms/cc	1.5×10^5	1.5×10^5	1.5×10^5	1.5×10^5
Water Absorption, %				
at 25 C. (7 days)	2.4	0.64	0.66	0.54
at 100 C. (7 days)	7.1	6.8	3.2	3.0
Forms Available	Extruded	Molded	Extruded & Molded	Extruded & Molded

Silicone Rubber Used for High Temperature Gaskets

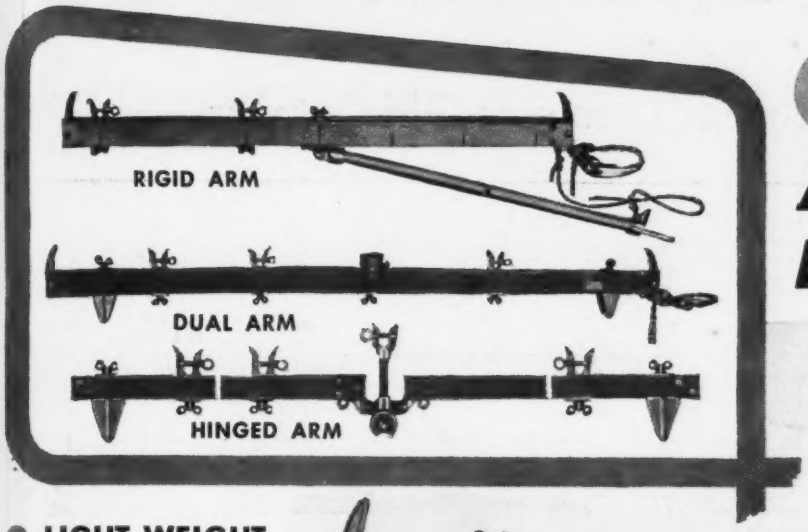
POLYORGANOSILOXANE, known familiarly as silicone rubber, has been developed in various compositions by the General Electric Co. Pittsfield, Mass. Among the new applications, the material is being used as gaskets in high-temperature equipment as in gas turbines, air compressors, and diesel engines; for the latter between the supercharger and diesel engine block because of the positive gasketing action provided at 300 F and 15 lb air pressure.

Superior Properties

Advantages of the silicone rubber for these applications include its ability to remain soft and resilient at high operating temperatures, its low

It's EASIER to Change .

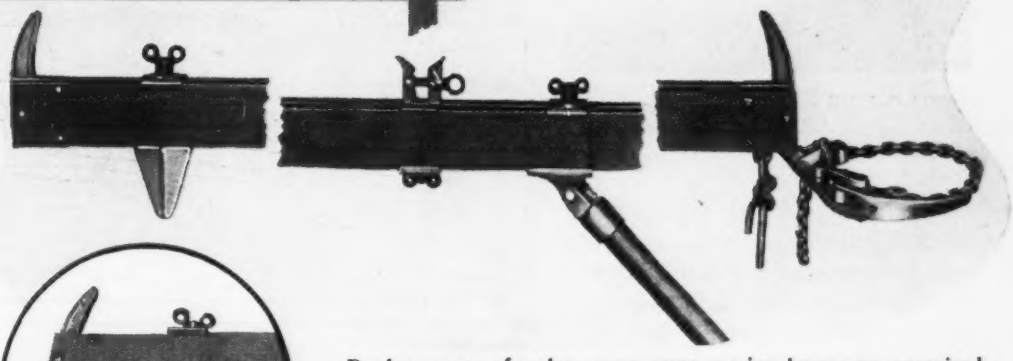
CROSS ARMS, INSULATORS, or POLES with

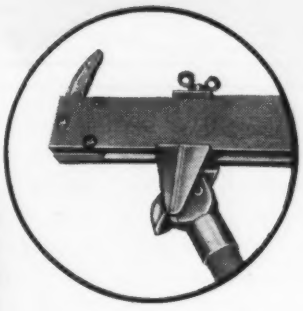


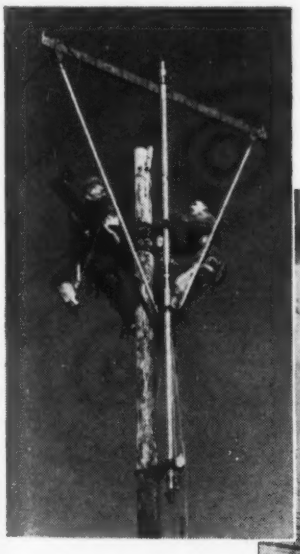
CHANCE

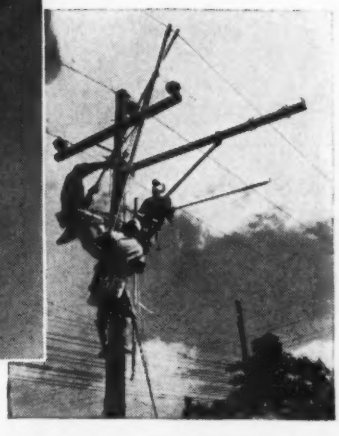
Aluminum Fitted AUXILIARY ARMS

- **LIGHT WEIGHT**
  Use of aluminum alloy gives weight reduction up to 14 pounds.
- **VERSATILE**
  Can be used as side or lifting arm. Adjusts to construction.
- **EASY TO APPLY**
  Lever-operated chain tightener saves time and effort.









Replacements of poles, cross arms, or insulators on energized lines are easily made with the new, *lighter* Chance Auxiliary Arm. Like all Chance Hot Line Tools, Auxiliary Arms have been redesigned and mechanically improved by the use of heat-treated aluminum alloy fittings for all metal parts with the exception of wing nuts and wire holder pins. The new aluminum fittings are illustrated above. Weight reduction varies with the size and type of the arm—ranging, in some instances, up to fourteen pounds.

The easy-to-apply, safe locking chain tightener has won enthusiastic approval from hot line crews because it enables linemen to mount the arm on the pole with surprising speed and ease. Less time is spent in juggling of equipment up on the pole, and the lighter equipment is much easier to handle.

A new bracket on the dual and hinged arms (circle) can be gripped by a wire tong head so the tong may be used as a brace.

Chance Auxiliary Arms are available in three styles—rigid, dual, and hinged. They are made of especially selected spruce and are tested to 75,000 volts per foot. The rigid and hinged arms may be used as side arms or lifting arms. The dual and hinged arms can be adjusted to lift all conductors at once on ridge pin construction. Write for complete information on Chance improved tools.

"THERE'S NOTHING TOO GOOD WHERE LIFE IS AT STAKE"

C4717

A·B·CHANCE CO·

CENTRALIA, MISSOURI · SAN FRANCISCO, CALIFORNIA

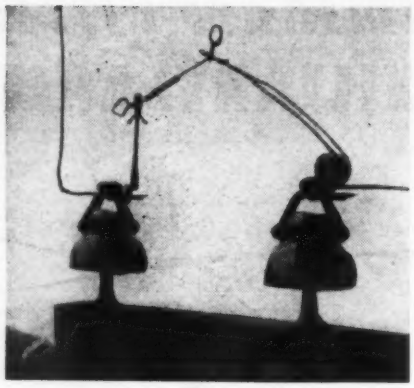
abc INDUSTRIES

permanent set and its nonadherence to metals. The heat resistance results in fewer replacements and less time lost due to repairs. Silicone rubber is also a good electrical insulator and has good arc resistance and nontracking characteristics.

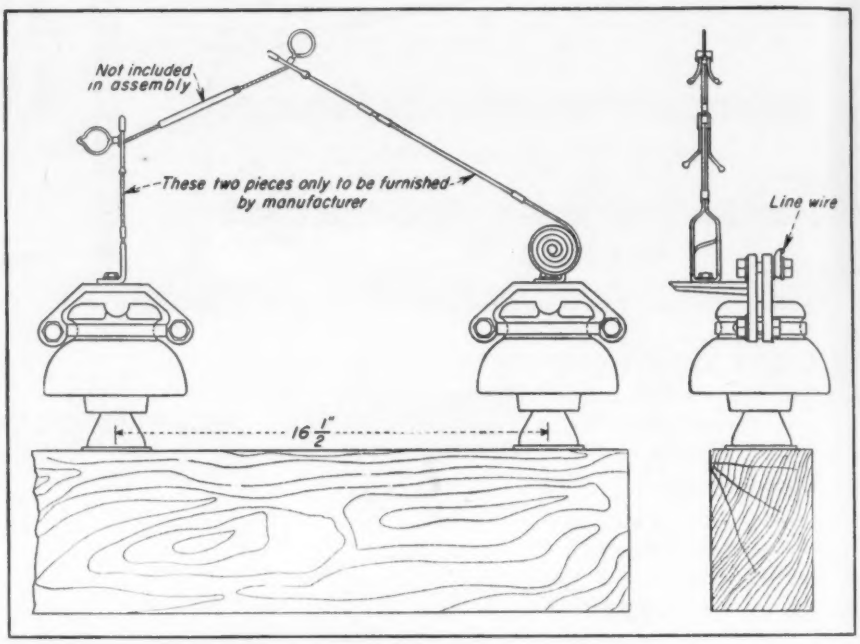
Properties of four forms are listed in the accompanying table.

• • •

Trip-O-Link Adapter Converts Old Cutouts



TRIP-O-LINK conversion adapters modernize old-type porcelain tube fuses



TRIP-O-LINK CONVERSION ASSEMBLY

THOUSANDS of old-type, 11-kv, porcelain tube fuse cutouts on the San Joaquin division of Pacific Gas & Electric Co are being converted to the modern Trip-O-Link type shown. Adapter parts furnished by the manufacturer are used in the conversion by completely eliminating the old porcelain tube knife blade fuse holder and mounting the Trip-O-Link supporting brackets on the insulator clamps that formerly held the fuse clips.

The whole conversion program is the outgrowth of a suggestion made by L. H. Miller several years ago. Since there were many thousands of the old porcelain tube cutouts in service as the result of standardization over a long period, it proved more economical to modernize by using adapter mountings made for the purpose by the manufacturer rather than to install completely new fuse brackets. More than 4,000 fuses have already been thus modernized.

• • •

Keeping Track of Rubber Protective Equipment

TO AVOID "loose ends" in routine procurement and handling of rubber protective equipment, the New England Power System maintains the following procedures:

1. All rubber gloves are purchased and rigidly tested under American Society for Testing Materials specification D120-23 before acceptance. Gloves are purchased as Class B, i.e., for use always under leather protectors.

2. After acceptance each glove is assigned a serial number for identification and record. This number is marked on the cuff, and assures the user's always receiving his own gloves after they have been tested.

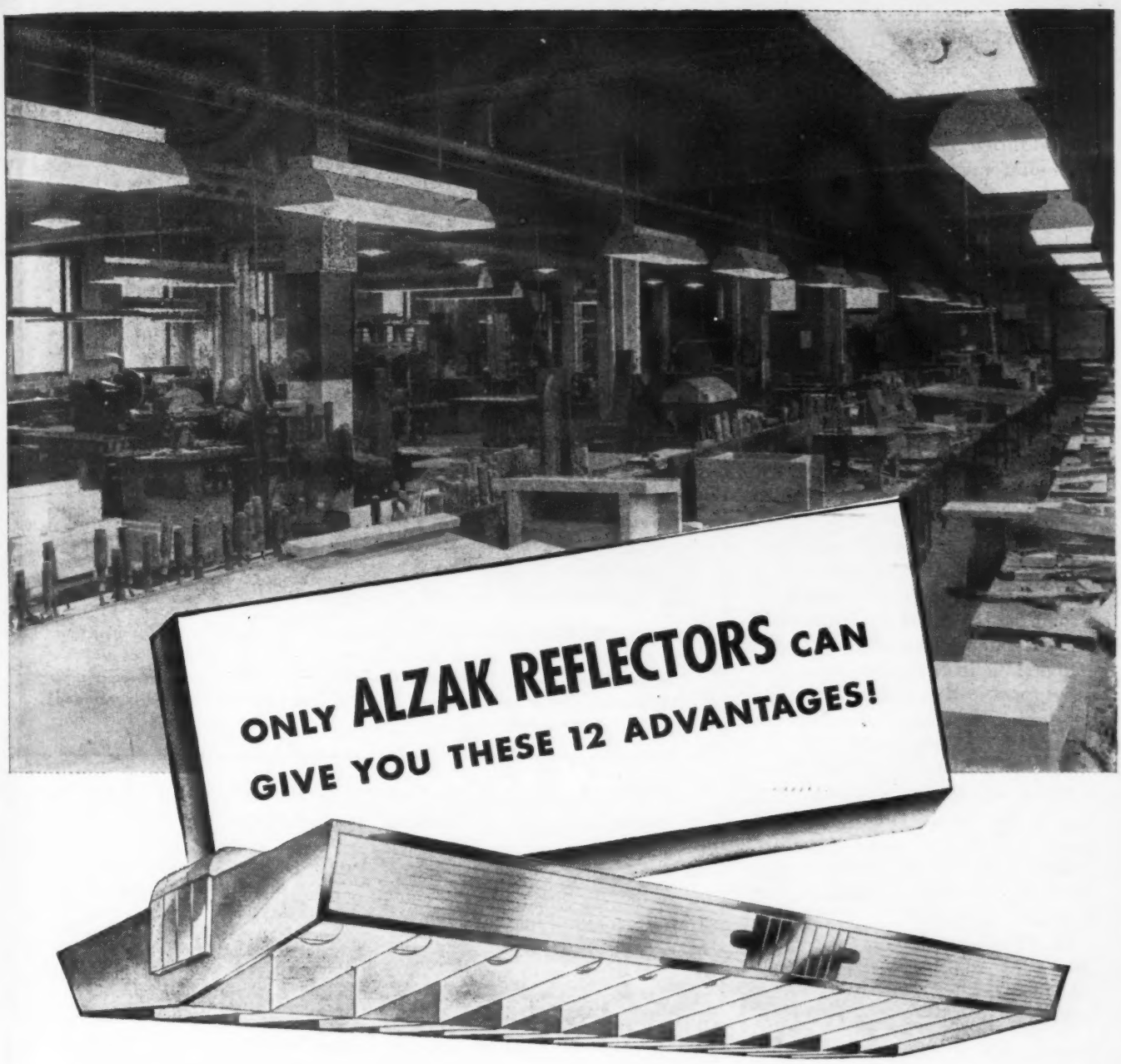
3. Each company in the System obtains its gloves through its testing laboratory and may carry in stock spare or unassigned gloves as determined by the management.

4. Each man using gloves is assigned two pairs. Each pair is required to be used every other month and tested during alternate months. Gloves once assigned to a man may not be transferred to another man except immediately after being tested. When such a transfer is necessary, it is dated against the new assignee's name on a test order and record at the next shipment for test.

5. Spare gloves must be used to equip newly hired men or to replace gloves damaged mechanically between testing periods. All gloves must be tested monthly, whether or not used during the intervening months.

6. Routine testing by the laboratory consists of washing and disinfecting, visual inspection for surface blemishes, scratches, cuts, etc., and the electrical tests required by the ASTM specification including future revisions of this.

7. Condemned gloves may be used for non-electrical purposes such as battery work, fireproofing cables, ap-



Here's what you get in an Alzak* Reflector . . .

- Reflectivity up to 83%.
- Choice of specular or diffuse finish.
- Tough, integral reflecting surface . . . cannot chip or peel.
- Light weight . . . easy to install.
- Aluminum all the way through . . . will not rust or spall if dented.
- Durable . . . cannot break under heat or impact.
- High efficiency with fluorescent lamps.
- High efficiency with infrared lamps.
- Easy to keep clean with soap and water.
- Withstands weather and industrial fumes.
- Available on all standard shapes of reflectors.
- Available NOW from leading reflector manufacturers.

For further information or the names of manufacturers of Alzak Reflectors, write to ALUMINUM COMPANY OF AMERICA, 1978 Gulf Bldg., Pittsburgh 19, Pa. Sales offices in 55 leading cities.

*Patented process

MORE PEOPLE WANT **MORE** ALUMINUM FOR **MORE** USES THAN EVER

ALCOA FIRST IN ALUMINUM

IN EVERY COMMERCIAL FORM

plying cable grease, washing automobiles, etc. Before using gloves thus they must be marked, as a safeguard against further use on electrical work, by folding over the back of the cuff and cutting a V-notch of at least 0.5 in. on each side, through the fold, this leaving a 0.5-in. square hole in the back of the cuff just inside the beaded edge.

8. A record of men assigned rubber gloves, together with the serial number and required sizes, is furnished with each shipment of gloves to be tested. Any glove failing on test will be destroyed or upon request returned to the owning company after being identified as a condemned glove in accordance with Paragraph 7. Condemned gloves are replaced with new gloves by the testing laboratory.

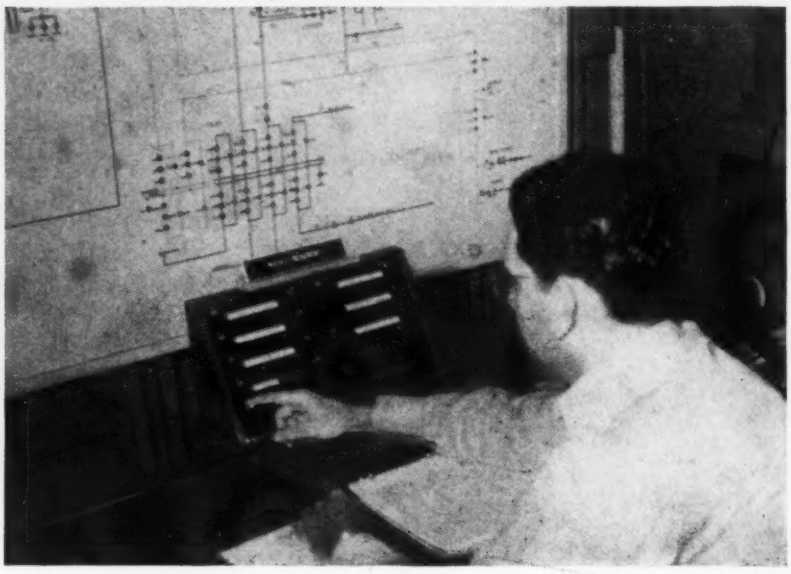
When a man leaves the employ of a company his gloves are included in the next shipment for test, and at the option of the returning company, may be returned to it as spares or held by the testing laboratory for replacements of future failures.

9. After testing, each pair of gloves is packed and shipped in a cardboard box by the testing laboratory. The glove numbers and user's name are written on the outside of the box, and the seal is not broken except by the assignee.

10. Rules for the use of rubber gloves are published in the System's safety handbook.

Rubber sleeves are available in two lengths: Elbow length for protection of forearm, and full length for protection of entire arm and shoulder. Both lengths are made in standard size to fit men of average build, and large size for bigger men. Sleeves are sent to the regional laboratory for test every month. Line hose is available in 1-in. inside diameter size for use on all wires up to and including 4/0 triple braid weatherproof. Standard lengths are 3, 4.5 and 6 ft. Insulator hoods are supplied in one size only, 14.75 in. long x 6.25 in. high, to fit all standard distribution insulators under 6 kv. These as well as line hose are sent to the laboratory for test on order of the local safety supervisor. Blankets are supplied in all rubber, size 36 in. x 36 in., with beaded edges and six reinforced eyelets; also available is a split blanket, 45 in. x 45 in., with slot to center, beaded edges and nine reinforced eyelets. Blankets are sent to the testing laboratory every three months.

Visual Dispatcher Record for Radio Cars



QUICK RECORDING of each radio-equipped trouble car is provided on this toggle-switch and light board in the dispatcher's office of Gulf States Utilities Co, Beaumont, Tex. Each light on the board represents a car, and card slips indicate the number and operator. Cars "in" and "out" of service are recorded by a flip of the switch

• • •

Appliance Consumption Checked by Portable Meter

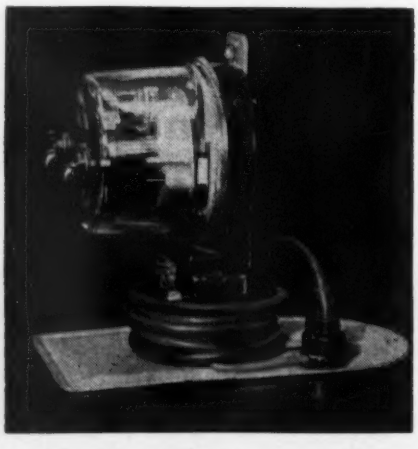
C. W. PINKEL
Belleville, Ill.

MANY CALLS to check kilowatt hour consumption on customers' appliances prompted our meter department to make up several portable check meters. These check meters are set on the appliances for seven to ten days and the customer is than informed of their kilowatt consumption.

Each check meter is made from a standard watthour meter and a few old parts. The base of the stand is made from discarded I-18 meter backplate to which is bolted a piece of angle iron about 2 in. wide. The Westinghouse O. B. meter is bolted to the upright iron and a socket fastened to the base. An extension cord is connected to the line side of the meter. This is plugged into customer's wall socket and then the refrigerator cord is plugged into the socket mounted on the check meter base.

The gear ratio on the meter was changed so that the first dial would register a kilowatt with one complete revolution (tenths for the divisions).

The meter does not take up much space in the customer's home and a number of customer complaints have been settled satisfactorily by its means.

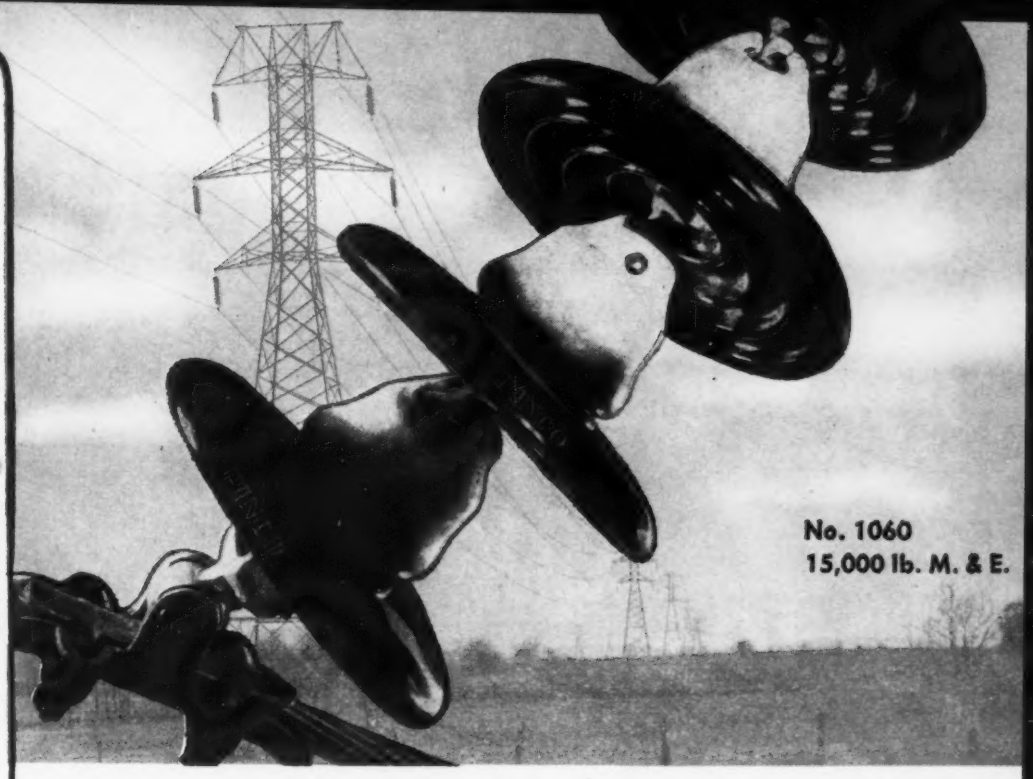


STANDARD METER plus a few old parts settle customer complaints

9

REASONS WHY PINCO SUSPENSION UNITS are *RIGHT on the job!*

1. **Pinco Porcelain** . . . wet plastic process, non-porous, homogenous, outstanding in dielectric qualities.
2. **Full Leakage Protection** . . . industry standards more than met.
3. **High Mechanical Strength** . . . assured by Pinco design refinements, quality standards, assembly techniques.
4. **Beaded Edges** . . . extra protection against gun shots, stones and other impacts.
5. **Corset Caps** . . . a Pinco innovation—minimizing possibility of corona discharge, providing most desirable loading on porcelain and giving maximum strength for weight.
6. **Stepped Forged Eyebolts** . . . preventing back thrust on porcelain in case of mechanical impact on pin.
7. **Socket Design** . . . extra strength, easier installation in strings.
8. **Thermal Protection** . . . provided by Pinco Resilient Compound where metal joins porcelain.
9. **One Design** . . . on 6", 7½" and 10" diameter units, assuring typical Pinco service from all sizes.



No. 1060
15,000 lb. M. & E.

Even After 30,000,000 Service Years . . .

. . . we don't *yet* know the "life expectancy" of Pinco Suspension Units. For on installations dating back to 1921, they have rolled up that service record without replacement because of electrical or mechanical failure. And even the oldest are still *RIGHT* on the job!

Nine "reasons why" are listed here. Use them as a check-list in specifying and buying. Make any comparisons you wish. Laboratory tests and service records both prove beyond question that it pays to "put up Pinco"!

PINCO INSULATORS

LOAD BUILDING

Mercury Lighting Costs Less Here

J. W. O'NAN
Duquesne Light Co
Pittsburgh, Pa.

THE ECONOMY of planned lighting is outstanding in the roll machine department (Pittsburgh Works, Coraopolis, Pa.) of the Continental Foundry & Machine Co. Study of possible ways to improve the lighting in this large shop resulted in decision to use the new 3,000-watt, mercury-vapor lamp, because only a few units would be needed, with consequent savings in installation and maintenance costs.

The 18 fixtures, totalling 56 kw, are spaced 40x50 ft and are mounted 35 ft high. Supply is 440 volt, three phase, same as the power circuits. This reduced wiring expense. Lighting intensity at working level is 24 ft-c.

ONLY 18 of the new 3,000-w mercury units were needed to provide 24 ft-c in this shop

• • •

Store Fronts "Moderne"

NEW STORE FRONTS display striking lines with lighting entering prominently into producing spectacular effects.

STORE FRONTS in California are displaying a trend "Moderne." Distinctive features are the striking lines, profuse use of plate glass and two-story display windows. All have one thing in common—special emphasis on illumination and lighting effects. Lighting ranges from high-intensity fluorescent, cold-cathode continuous tube, recessed incandescent with prismatic glass, to various combinations of all.

Neighborhood stores and shopping centers are springing up on every hand. Many are along arterial highways. Illuminating engineers are prominent, particularly utility men, in every new undertaking. As load

EXIDE BATTERIES... READY FOR POWERFUL ACTION THE INSTANT IT'S REQUIRED

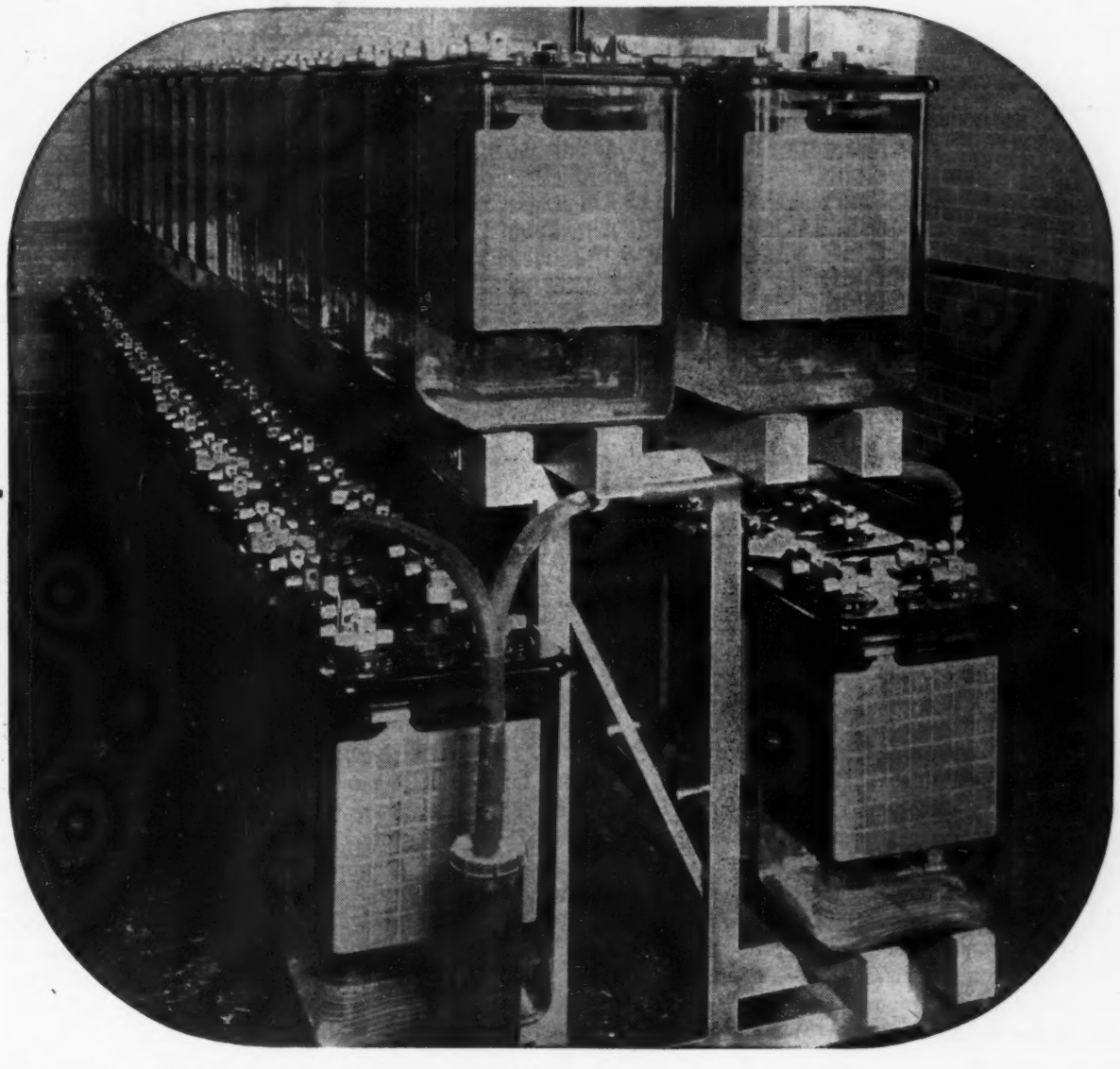
With Exide Batteries on duty you can count on a prompt and powerful response whenever there's a storage battery job to do. In central stations throughout the country, Exide Batteries are used for a wide variety of applications — closing and tripping switch-gear, control bus operation, emergency lighting and other storage battery tasks.

Exide Batteries have earned the confidence of engineers everywhere, and their widespread use is proof of their dependability, long-life and ease of maintenance.

Whatever your storage battery problems may be, Exide engineers will be glad to help you solve them.

Exide
BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
Exide Batteries of Canada, Limited, Toronto



builders these new-type stores rate high because lighting is liberally used on fronts and interiors to create the spectacular. In fact, the effects are largely built *around* lighting.

Back before the war the industry in California conceived the idea of somewhat reversing selling tactics on store lighting. Instead of concentrating so largely on interior lighting, and assuming that improved window lighting would follow as a matter of course, lighting men got back of store front modernization and window lighting, the line of least selling resistance, and reasoned that modernization of interior lighting would follow as a matter of necessity. It worked—and the theory is now paying off handsomely. Of course, architects and the materials industry deserve much credit, too, for they supplied designs and participated wholeheartedly.

• • •

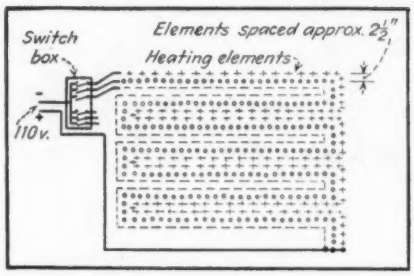
Electric Home Heating in Korea

EMMETT A. PARRISH
Major, Air Corps

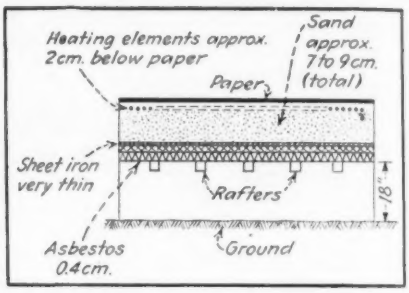
ROOM TEMPERATURES ranging from 70 to 80 deg F, with outdoor readings from 10 above to 10 below zero, are maintained in a house in Inchon (Jensen), Korea, by electric heating units laid in the floor. The installation, an experimental one which is still in operation, was made in 1937 by the Japanese manager of the local electric company. The house is now occupied by his American Army successor, the author of this article.

This is not strictly a radiant heating installation. It was designed to heat the floor, on which Koreans customarily sleep. The room measures 10 x 14 ft. The total load is 3 kw in six individually switched circuits of 500 w each as shown in the accompanying diagram.

On a base floor of wood is a layer of asbestos, 4 cm thick, over which is a sheet of very thin steel. On this is a layer of fine sand 6 to 8 cm deep. The heating elements are laid on this and covered with about 2 cm more sand. The sand is covered with heavy paper. Since the Koreans go barefoot indoors the heavy paper was adequate for their use, but it does not hold up so well under the heavy pounding of American army shoes.



LAYOUT OF CABLES for floor heating. One-half of floor is shown; the remaining half has a similar plan. Each heating element is 11 m long. The total load is 3 kw in six individually switched circuits of 500 w each



CROSS-SECTION VIEW of floor showing method of construction. The heavy paper topping is adequate for barefooted Koreans, but it does not stand up under GI brogans

Each heating element is a continuous length of nickel chromium alloy wire of about 1 mm diameter. The covering of the wire consists of a winding of asbestos cord, two layers of paper, sheathed in lead. Over the lead are two wrappings of tar paper. Each element is 11 m long. Three elements are used in each half of the room.

• • •

Cooperative Survey Analyzes Sales Methods

FINANCED BY UTILITIES and distributors, a "down-to-earth" survey of appliance selling methods in 105 retail establishments was recently completed under the auspices of the Electric Institute of Boston, Inc, the work being done by Public Analysis, Inc, Boston, over a period of about one month. Consent having been obtained by the Institute from the dealers, incognito calls were made at their stores by shoppers for electric refrigerators, vacuum cleaners, radios, home freezers, irons, washers, toasters and broilers, a keyed report being made on each call and a copy sent to the individual dealer. Summaries were prepared as the survey advanced, and at the end the over-all results were highlighted at a meeting attended by over 500 representatives of the industry. No establishment was identified, but the selling practices of the stores, the appearance, employee competence and quality of merchandising efforts put at the customers' disposal were graded and evaluated, and a remarkable presentation made of the "inside workings" of shops ranging from the largest department stores to so-called "holes-in-the-wall." About 10 percent of the electrical retail outlets in the Boston area were covered.

The need for improving methods was brought out repeatedly, indicating in detail weak spots wanting correction. Courtesy ranked high in the findings, but inadequate knowledge of appliances sold, poor follow-up, and failure to make sufficient use of manufacturers' sales aids were widespread. Better selling on the part of dealers, employees, utility personnel and manufacturers as an aid to load building was generally recognized as a vital necessity in post-war merchandising.

IF BURNOUTS SHOULD OCCUR—

Transite Ducts will not spread Smoke or Fumes

These incombustible Transite Ducts will provide greater safety if burnouts should occur.

. . . because TRANSITE is inorganic—incombustible!

Two great hazards . . . smoke and fumes . . . are less dangerous when you specify Transite Ducts for underground cableways. Made of asbestos and cement, Transite is inorganic and incombustible. It will not support flame, or contribute gases to a possible manhole explosion if burnouts should occur.

In addition to this vital safety factor, Transite Ducts offer these four other important advantages:

1. Easy to Install—Transite Ducts come in long, light lengths that are easy and economical to assemble and install.

2. Corrosion-Resistant—Transite is inorganic—cannot be affected by corrosive soils. It is made of asbestos and cement combined under great pressure into a permanently strong structure.

3. Immune to Electrolysis—Entirely inorganic and non-metallic, Transite Ducts are not affected by electrolysis or galvanic action.

4. Permanently Smooth Bore—Long cable pulls and replacements are easy with Johns-Manville Transite Ducts. And this smooth bore minimizes damage to cables.

For further information on how Transite Ducts can *increase the safety* and *cut the costs* of Cableway systems, write to Johns-Manville, Box 290, New York 16, New York.

JOHNS-MANVILLE JM PRODUCTS

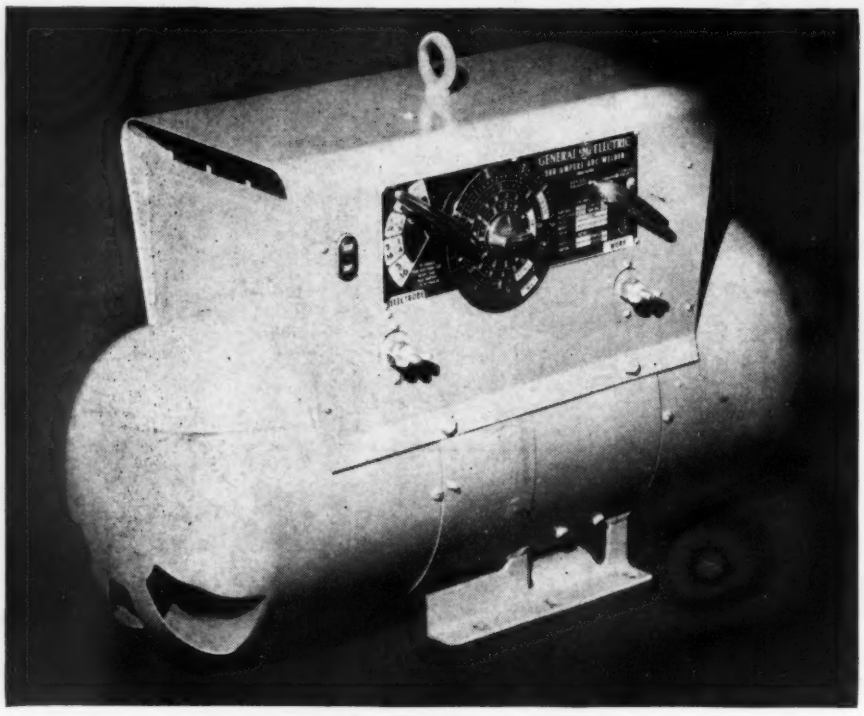
Johns-Manville

TRANSITE DUCTS

CONDUIT for use without concrete

KORDUCT for concreting in

NEW EQUIPMENT



Heavy-Duty Arc Welder

A NEW LINE of heavy-duty single-operator d-c arc welding machines, announced by General Electric Co, Schenectady, N. Y., have been designed for improved welding characteristics and a 50 percent saving in over-all size and weight. Operating at 3,500 rpm, the new welders, type WD-40, are available in 200-, 300-, and 400-amp NEMA ratings.

The arc is reported to be easily established and maintained with the new welders because more than full arc voltage is generated instantly after short circuit, thereby largely eliminating arc pop-out. Excessive weld spatter is reduced because current peaks are adjusted for best performance on any setting.

With a current presetting arrangement, a tap switch handle in the form of a pointer is set to the electrode size being used. It then automatically points out the proper one of several graduated scales on the face of the current-setting dial. This indicates the current range which should be used and permits precise adjustment of the welder output.

Standard assembly includes a stationary welding generator, driving motor, control cabinet and panel, and a motor starter. A two-wheeled, balanced running gear is available as an optional feature.

•

Electronic Meter

A NEW electronically operated Area meter developed by Bailey Meter Co, Cleveland, Ohio, is said to measure accurately the more viscous liquids: black liquor, tar, chemicals, distillates, and refrigerants as well as freer flowing liquids: water, oil, gasoline, etc. This flow-measuring instrument consists of a telemetering transmitter connected to a standard Bailey electronic receiver. The transmitter is installed in the pipe line, much like a valve. The meter is designed for 115-volt, 60-cycle circuits and requires approximately 60 va.

The recorder may be calibrated to read in terms of volumetric units, thereby reducing errors due to density changes. Two transmitters may be connected to the same recorder to measure the ratio, sum or difference of two flows.

Transmitter has a port area varied by a plug restrained with a calibrating weight or spring. The plug assumes a position proportional to the rate of flow. This results in a substantially constant pressure drop, usually 2 psi. if a weight is used for calibration, or 10 psi. if a spring is used.

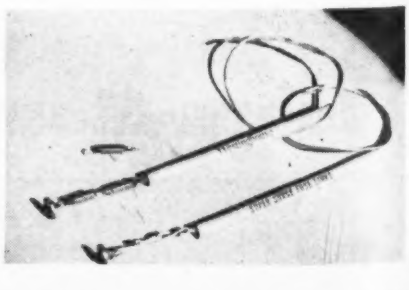
The plug is directly connected to the soft iron core of the telemeter transmitter and any movement of the plug causes a voltage ratio variation in the telemeter circuit. This variation is transmitted to the receiver, which may be an indicator, recorder and/or controller. The electronic receiver employs an impedance bridge measuring circuit which is extremely sensitive to any unbalance in voltage ratio and therefore reacts to the slightest movement of the plug.

•

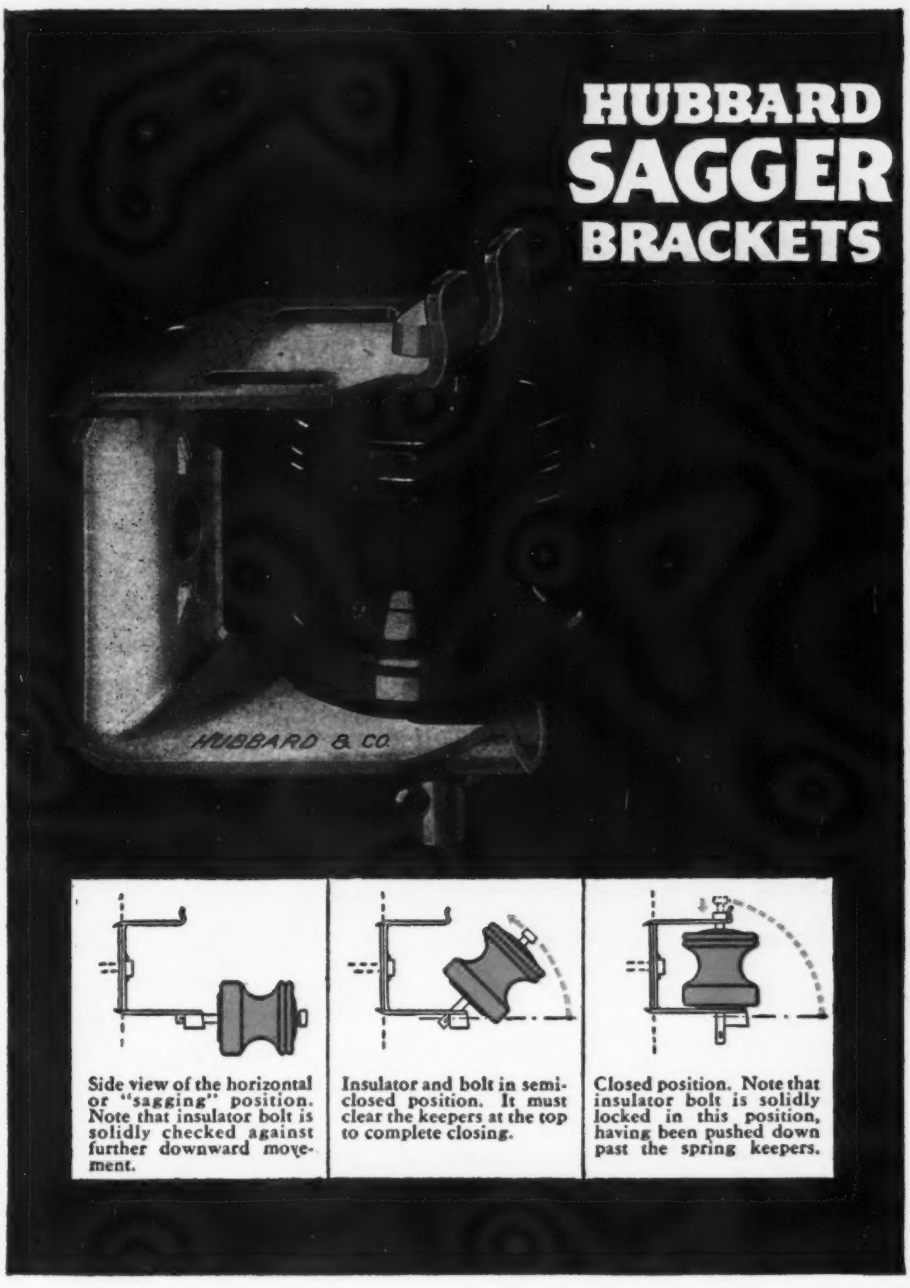
Super Surge Fuse Links

LIGHTNING SURGES and temporary heavy loads within the permissible range of transformer thermal capacities can be carried safely by a new line of primary distribution fuses announced by the Westinghouse Electric Corp, P. O. Box 868, Pittsburgh, Pa. Designed especially for transformer fusing, the new links are the universal type for any indicating or non-indicating NEMA standard distribution porcelain cutout box up to 15-kv rating.

The new Super Surge fuse links will blow on sustained overloads like any "N" rated fuse but will continue to carry the current during short-time heavy loads within the thermal capacity of the transformer or when carrying lightning surges within the transformer surge level that would operate the conventional fuse under a 15-amp size. The time-current curve of the new link is identical with the American Standards Association safe loading curve for small distribution transformers. This makes available most of the thermal overload characteristics of the modern



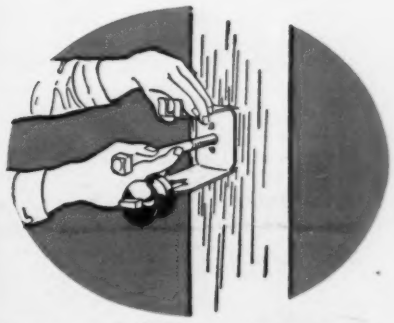
Something NEW IN SECONDARY DISTRIBUTION



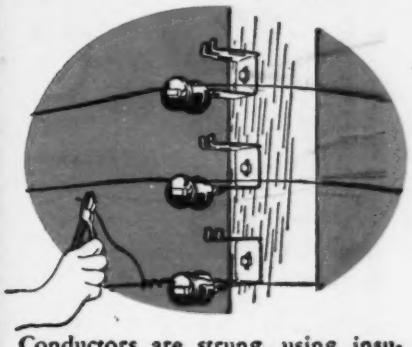
Side view of the horizontal or "sagging" position. Note that insulator bolt is solidly checked against further downward movement.

Insulator and bolt in semi-closed position. It must clear the keepers at the top to complete closing.

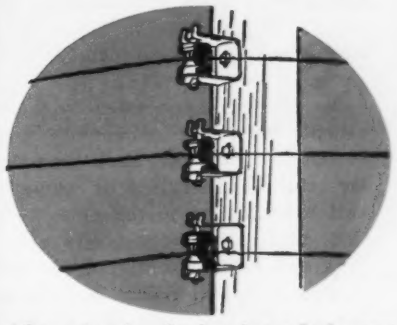
Closed position. Note that insulator bolt is solidly locked in this position, having been pushed down past the spring keepers.



Holes are drilled at correct spacing and machine bolt is inserted as shown.



Conductors are strung, using insulators as pulleys, until desired sag is obtained after which they are tied-in while still in the horizontal position.



After tying-in, the insulator bolts are raised to the vertical and dropped into the lock position.

For secondary distribution circuits, where a variety of problems are to be met, Hubbard No. 710 Sagger Bracket is the most flexible choice to meet the requirements. This Bracket may be described as a single, *separate,* secondary-rack point, which may be used with one or more similar points, at any desired spacing for any number of conductors.

No. 710 Brackets are versatile in other ways also. The patented feature is the arrangement of the insulator bolt which may be dropped to a horizontal position to allow the "sagging" of conductors with the insulator spool acting as a pulley. Insulator Bolts are locked in position when closed or open. Strength against line pull is provided by the broad back bearing against the pole, the backs being 3-inches in width. Spurs at the corners prevent the bracket from turning during and after installation. Bolt heads are trapped in the back to prevent turning while tightening.

Hubbard Sagger Brackets have been tested and proved in service. Highly adaptable to any conditions, they have drawn praise from engineers, in every instance of the many installations made to date.

HUBBARD AND COMPANY

PITTSBURGH • CHICAGO **OAKLAND • CALIFORNIA**

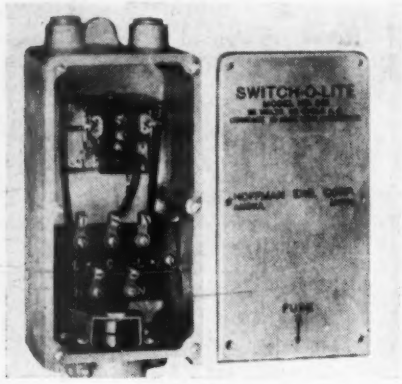
transformer while a better protective ratio for transformer fusing can be obtained.

Fuses are available in the 1-, 2-, 3-, 5-, 7-, and 10-amp sizes.

•

Magnetic Light Switch

AN ENCLOSED RELAY developed by Hoffman Engineering Corp, Anoka, Minn., is available for installations



which may require 3- and 4-way switches. Known as the Switch-O-Lite, it consists of a spst, magnetically operated latch-type relay, fuse holder and terminal board, all housed in a cast aluminum weatherproof enclosure. Rating is 10 amp, non-inductive, 11.5 v, 60 cycles. An operating coil is suitable for continuous duty.

No current is consumed by the relay except when the momentary contact switch is depressed. Each time the relay coil is energized it causes the switch to change to the opposite position, that is, if the contacts are open they will close. Next time the coil is energized it will return the switch to the original position. Each resultant impulse energizes the relay coil, which latches either in an "on" or "off" position, switching the light either "on" or "off."

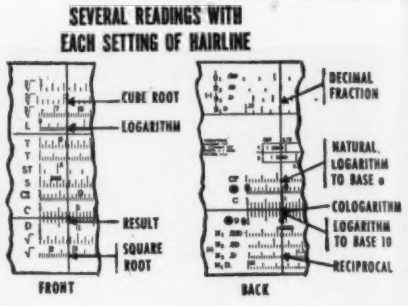
•

Air-Cooled Transformer

IN A LINE of dry-type distribution transformers, the use of Class B, heat-proof insulation such as fiber-glass, mica, asbestos, and other inorganic materials is included as among the features announced by Marcus Transformer Co, 32 Montgomery St, Hillside 5, N. J. Other features are compact, built-in, low-voltage wiring compartment suitable for conduit wiring, and improved natural draft. Designated as type S, the transformers are available in both single- and three-phase units up to 100 kva and for voltages up to 4,800.

Deci Log Log Slide Rule

A NEW DECI log log slide rule, designed to simplify computation, is announced by Pickett & Eckel, Inc, 5 South Wabash Ave, Chicago 3, Ill. The scales, on the front of the rule, are so arranged that only one setting of the hairline gives with each result its square root, cube root and log. The log log scale on the back is expanded for accuracy, and arranged to give these five readings with each setting of the hairline: (1) decimal fraction to four and five figures; (2) its reciprocal to four and five figures; (3) log; (4) colog; (5) natural log to base. The scales read from one ten billionth to ten billion, and give decimal point location. A simple legend tells which



scale to read when raising to powers. The slide rule is made of magnesium alloy with plastic surface bearing permanent, expanded, easy-to-read washable scales. Size is 12⅛ x 2⅛ x $\frac{1}{16}$ in. A carrying case and instruction manual are furnished.

• • •

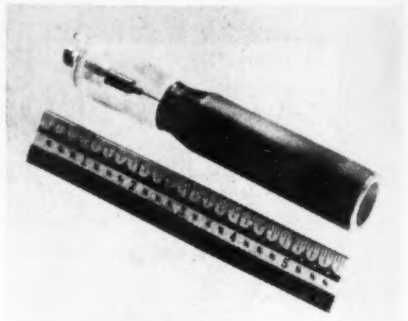
Geiger Tube

A NEW, multi-purpose, self-quenching Geiger tube for use with Beta, Gamma and soft X-radiation has been announced by North American Philips Co Inc, 100 East 42nd St, New York. Essentially, the construction consists of a tubular chrome iron cathode having a mica window of high transmissibility at one end and a glass section for supporting the anode at the other end.

Overall length of the new Geiger tube is 6 in., diameter is 1 in. Length of the metal cathode is 3¾ in. Anode is 4⅛ in. long and bears a glass bead at its free end. Mica window averages approximately 3.2 milligrams per square centimeter.

The tube may be used for tracer work employing C^{14}, for soft X-radiation and for operations involving radium. Used with suitable circuits, it is capable of handling in excess of 3,000 discrete counts per second.

Threshold voltage is 1.350 and the plateu exceeds 300 volts in length. Normal operating potential is 1,450. Laboratory tests indicate that this tube will have a life exceeding 10^{9} counts. Quantum efficiency for soft X-rays is in the order of 70-80 percent.

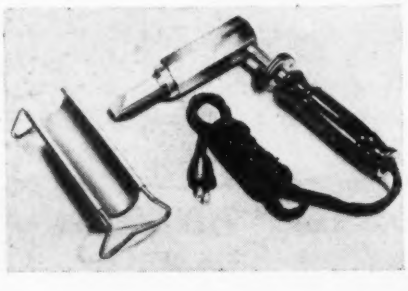


• • •

Soldering Iron

A HATCHET TYPE electric soldering iron is an addition to the products of Hexacon Electric Co, 206 West Clay Ave, Roselle Park, N. J. Designated Cat. 300-H, the new iron is stated to be balanced in weight and enables the operator to solder in a more natural position, eliminating fatigue.

The heating element is nickel-chromium resistance wire, insulated with mica, and can be replaced. It is housed in a hexagonal shaped barrel which can be clamped in a vise for easy tip removal. Tips are hard drawn copper. A 6-ft heater cord and a stand are furnished with the iron.

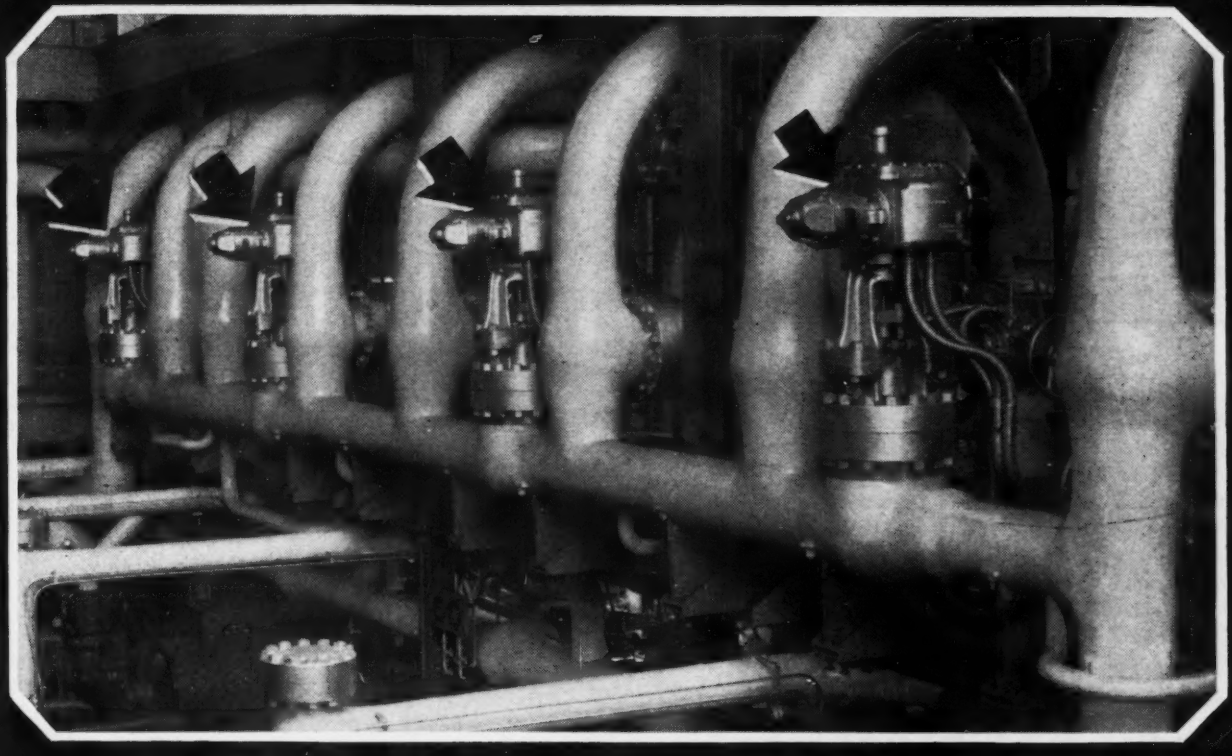


•

Speed Indicator

NOW AVAILABLE are the Type 42 electric tachometer indicators designed for equipment manufacturers and produced by Metron Instrument Co, 432 Lincoln St, Denver 9, Colo. These indicators can be used with any of the Metron tachometer heads for direct measurement of any speeds ranging from 1 rpm up to 100,000 rpm. Over 50 standard speed ranges are available and the dial

HUNDREDS upon HUNDREDS
of *Limitorques* are in daily, dependable use—



—in Central Stations, Industrial Power Plants Oil Refineries and Process Industries in America

Limitorque Automatic Valve Operators are the modern, quick, safe and economical way to open and close plug, cock, globe and gate valves . . . *by local and remote control.* They are widely used on Steam, Water, Gas, Air, Oil and Process Liquid Lines,—and are being installed in ever-increasing numbers. . . . Just a *"push of the button"* sets them in operation. Limitorques are "self-contained", and weather, dust and fume-proof. They are readily bolted-on to the valve yoke, and need no extra gears, nuts or bearings. In addition, they are *absolutely safe*, because the Torque Seating Switch insures tight valve closure, without strain on disc, seating rings or valve stem . . . Protection from damage due to "foreign objects" is positively prevented, because the motor is shut-off by thrust exerted on the valve disc.

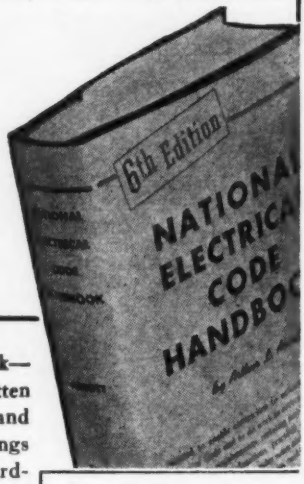
Send for latest literature,—and please use your Business Letterhead when writing for same.

Philadelphia GEAR WORKS INCORPORATED
ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO . . . IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

How to handle all kinds of wiring and installation jobs

in strict compliance with the latest National Electrical Code



Here is the long-awaited electrical contractor's job-book—the first revision in six years—almost completely re-written in accordance with the new 1946 Code requirements and planned to enable electricians to understand the new rulings of the National Electrical Code and to do work in accordance with it. It restates involved rules in simple language; it provides explanations, furnishes practical directions, and is filled with diagrams showing what the Code rules mean and how to apply them. A special arrangement group rules, making it easy to find all the rules applying to any given job.

Just Out—6th Edition

National Electrical Code Handbook

By Arthur L. Abbott

633 Pages, 5 x 7½, 418 illustrations, $4.00

This handbook is one of the most unusual and helpful electrical books published. It gives a wealth of information from the practical angle of getting jobs done according to code requirements. It saves delay in starting jobs, it saves time and money in avoiding false starts, errors and violations. At the same time, it contains so much clearly presented information that it will pay you to use it for general reference on many questions of material, plans, wiring, and installation.

Based on the 1946 National Electrical Code— adopted as the 1947 Code

Covers all the new Code revisions, showing you:

—how to reduce wiring costs for ranges

—how to protect motors against mechanical injury

—how to install infra-red lamps

—how to install capacitors for power-factor correction

—how to protect transformers against overcurrent

—how to wire rigid conduit for voltage not exceeding 15,000

—how to form "stress cones" at cable terminations

Read this partial list of contents:

approved types of wiring
installation requirements applying to all types of wiring
cable assemblies
raceways—requirements applying to all raceways
underplaster extensions
outlet, switch and junction boxes
switches — panelboards — switchboards
electrical appliances
motors—motor controllers
motor wiring and protection
generators—transformers—autotransformers
capacitors—resistors and reactors—lightning arrestors — storage batteries
grounding
overcurrent protection
design of wiring installations—branch circuits—feeders and services
outside wiring
remote-control—signal and low-energy power systems
elevators—cranes and hoists
construction of materials

All rules for a job grouped in one place

Once you have looked up a rule in this handbook, you may rest assured that you will not find later that there was another rule to be considered and that the job will have to be done over. It reduces a maze of scattered rules to a logical and understandable system.

It explains how the Code applies to:

- **commercial buildings**
- **homes**
- **factories**
- **theaters**
- **hazardous locations**
- **signal systems**
- **high-voltage equipment**
- **television equipment**
- **motor installation**
- **design of installations**

See this helpful book 10 days FREE

JUST MAIL COUPON

McGRAW-HILL BOOK CO., 330 W. 42 St., NYC 18

Send me Abbott's NATIONAL ELECTRICAL CODE HANDBOOK for 10 days' examination on approval. In 10 days I will send $4.00 plus a few cents postage, or return the book postpaid. (Postage paid on cash orders.)

Name .....

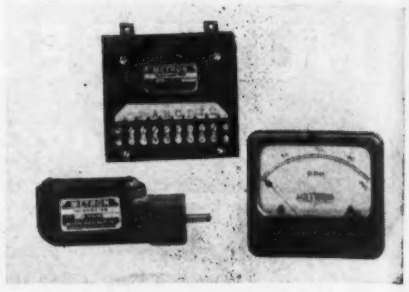
Address .....

City and State .....

Company .....

Position W-8-30-47

(For Canadian price, write McGraw-Hill Co. of Canada Ltd., 12 Richmond Street E., Toronto, I.)



can be calibrated in any units such as knots, pounds per hour, feet per second, rpm, impressions per hour.

These tachometers complete consist of three units: the tachometer head, which can be located any distance from the indicator; the indicator, which is mounted on any convenient panel surface; and the junction box, which can be located any place (usually on the rear of the panel). Operating power is obtained from 110 v, 60 cycles or whatever d-c voltage is available. Accuracy of 1 percent is reported.

•

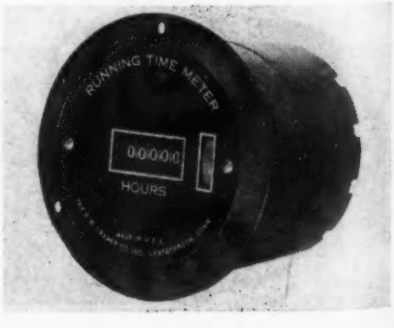
Resonant Relay

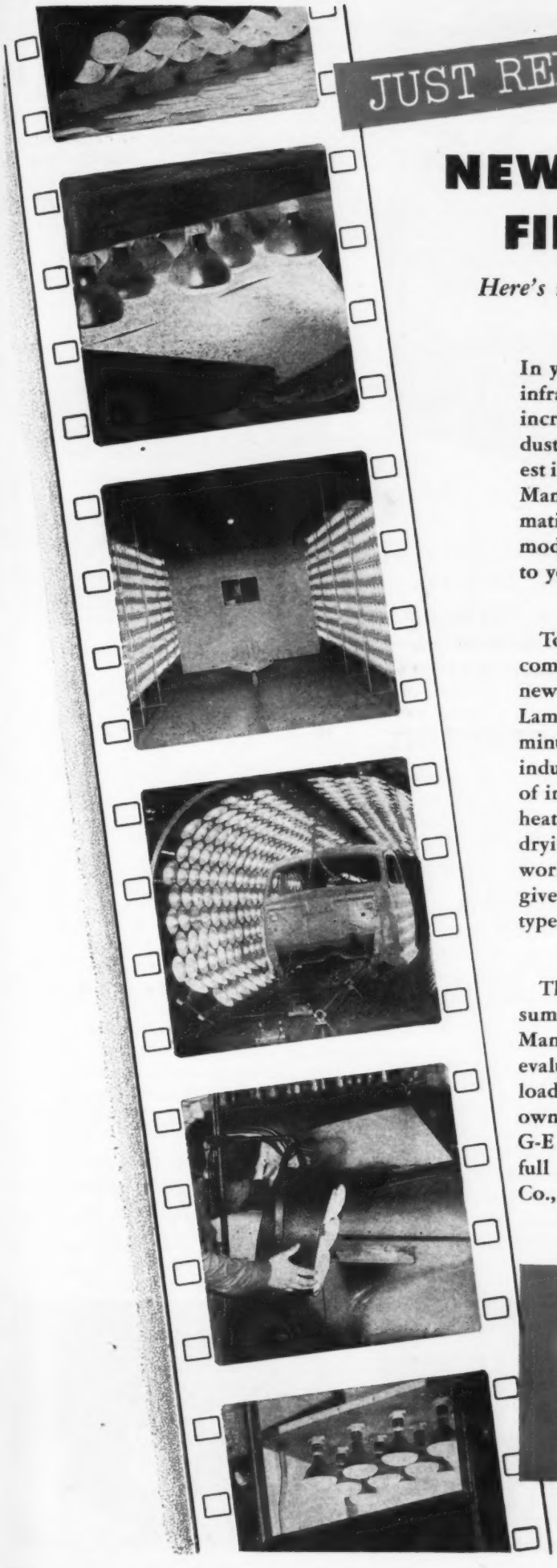
TYPE 182 resonant relay, a product of Stevens-Arnold Co, 22 Elkins St, Boston, Mass., now has a range extended downward to 20 cps and includes 60 cps as a standard model; previously the range was 153 to 1,000 cps. This relay with a vibrating reed mechanism provides remote control by radio or carrier current through frequency discrimination. Only a small amount of energy is required to operate the relay at the distant point and, by connecting an auxiliary relay or a thyratron to the relay, almost any switching operation may be accomplished at the remote location.

•

Running Time Meter

A NEW TIME TOTALIZER or running time meter features a counter that can be reset to zero and is manufactured by The R. W. Cramer Co, Inc, Centerbrook, Conn. Designed for use on a-c circuits, the meters automatically register total operating or idle time of the circuit, machine or system to which con-





JUST RELEASED:

NEW G-E SOUND SLIDE FILM ON INFRARED

Here's more power for your power sales program!

In your job of selling "more power to America", infrared lamp ovens deserve active promotion as an increasing source of desirable industrial load. There's a lively interest in Infrared throughout industry. Many manufacturers want full information and are eager to try this modern heating method. They look to you for counsel.

See the New G-E Promotion Kit

To help you sell Infrared, General Electric offers a complete promotion kit, built around showings of the new full-color sound slide film entitled "Infrared Lamps for Better Production." This interesting 30-minute picture story makes it easy for you to acquaint industrial production people with the many advantages of infrared energy for baking, preheating, dehydrating, curing and drying. It explains how Infrared works, shows typical applications, gives a quick education on lamp types and oven arrangements.

New Manual Gives the Facts

The entire G-E Infrared promotion program is summed up in a new 40-page Power Salesman's Manual. It contains all the information you need to evaluate Infrared as an industrial load builder and to organize your own local promotion. Call your G-E Lamp representative today for full information. General Electric Co., Nela Park, Cleveland 12, Ohio.

G-E LAMPS

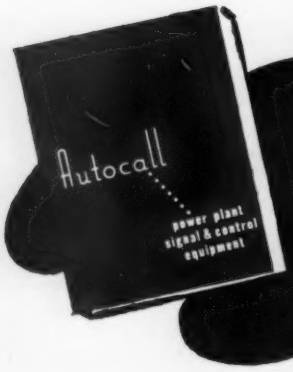
GENERAL ELECTRIC

Maintain
CONTINUITY of SERVICE
with
"Autocall" supervision

Continuous human inspection of power equipment has proved to be physically impossible. To warn, **before failure,** when unusual conditions exist in any power equipment, is a duty for an Autocall Supervisory System!

Autocall supervision informs your power operators, load dispatchers, and other responsible personnel of such conditions, automatically and instantly, by means of audible-visual type annunciators and an automatically printed log record, in plain English, of all station operations!

Typical equipment to provide this supervision—the 7 feet high Type "AND" annunciator, the Autocall Power Operator's Desk, (with built-in Print Recorders for producing the log record), and a sample of the printed record—is shown above. For complete details of these, and other Autocall equipment, send for your copy of the booklet shown below. There is no obligation.



THE Autocall CO.
REG. U. S. PAT. OFFICE
211 TUCKER AVENUE
SHELBY, OHIO

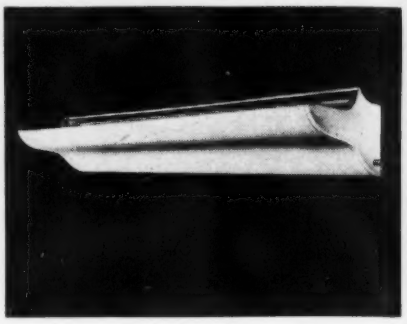
nected. Counter indicates in tenths up to 10,000 hours and then repeats.

Three models are available: one for table use, one for conduit connection, and one for flush panel mounting. They can be furnished for 60 or 50 cycles, 110 or 220 v. Each is operated by self-starting, slow-speed synchronous motor.

•

Germicidal Units

AN ADDITION to the Silv-A-King line is a new germicidal unit announced by Bright Light Reflector Co, Bridgeport,



Conn. The fixtures can be mounted on the wall or suspended from the ceiling and the opening is toward the ceiling. Radiation is stated to be above the sight level and horizontally across the room, affording occupants positive protection against direct radiation while maintaining maximum concentration of germ-killing energy. The unit is available in two sizes—one for 15-w, other for 30-w, either General Electric Co or Westinghouse lamps. Each size is available with an 8-ft cord and plug.

•

Motor-Starting Capacitors

PRODUCTION of electrolytic capacitors suitable for use in starting circuits of 110 and 220-v a-c motors is announced by Tobe Deutschmann Corp, Canton, Mass. In the 110-v rating, available capacitances range from 20 to 420 mf; in the 220-v rating, from 20 to 60 mf. Operating temperature range for these units is from 76 F to 185 F.

For convenient incorporation in the motor housing, these motor-starting units are provided in round metal cases

ALUMINUM COVERED

NOW AVAILABLE For Prompt Delivery!

BUTLER BUILT

Trussless RIGID FRAME STEEL BUILDINGS

Low Cost Per Square Foot Erected

Yes, you actually pay less today for Butler Trussless rigid frame buildings, covered with top-quality aluminum, than you paid for truss type galvanized steel covered buildings before the war. By concentrating production lines on a unique 40-foot wide building of a simplified and versatile design, Butler factories have overcome high material and labor costs. Length may be any multiple of 20 ft. Greater width is readily obtained by erecting 2 or more buildings side by side and omitting adjoining side walls.

You get all the advantages of extra headroom, extra strength in relation to weight, simple assembly, mobility and fire-safeness, *yet you pay less.* Don't delay expansion plans any longer. Delivery and erection are a matter of weeks instead of months. Mail coupon today for details.

- Straight Side Walls For Full Useable Space.
- Low Cost Per Sq. Foot.
- Trussless Gable Roof.
- First Quality Aluminum, Deeply Corrugated, Heavier Than 24-gage.
- Readily adaptable to many oil field, refinery, pipe line, bulk station, supply depot, and warehouse uses.

BUTLER BUILT
Reg. U.S. Pat. Off.

STEEL BUILDINGS
Aluminum Covered

BUTLER

The Mark of Better Quality

Send Complete Information On Butler Trussless Rigid Steel Frame, Aluminum Covered Building Size 40′ wide x 100′ long.

BUTLER MANUFACTURING COMPANY
FACTORIES: KANSAS CITY • GALESBURG • MINNEAPOLIS

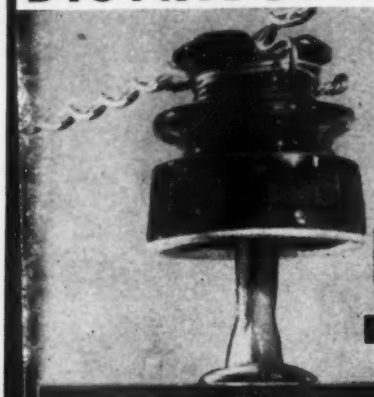
Address inquiries to
7336 E. 13th St., Kansas City 3, Mo. or
936 Sixth Ave. S. E., Minneapolis 14, Minn.

FIRM NAME .....

ADDRESS .....

CITY ..... ZONE ..... STATE .....

LOOK TO LOCKE FOR
DISTRIBUTION MATERIALS...



PINS *and*
PIN TYPE
INSULATORS
FOR EXAMPLE...

Here is a Locke No. 77 pin type insulator on a No. 881 pin—used extensively on distribution lines.

The pin is forged steel, with *Permazinc* — Locke's *Quality Controlled* double hot-dip galvanizing — for extra years of dependable performance.

Both pin and insulator threads are accurately formed, assuring a proper fit. The insulator is of wet process porcelain for best electrical characteristics, with *Compression Glaze*—originated by Locke—for highest mechanical strength. Pins and insulators are designed together and made together to work together.

Complete lines of distribution materials are maintained in six Locke regional warehouses and in most distributors' stocks. Call in your Locke representative.

Depend on Locke for Quality Controlled distribution materials—pole line hardware and insulators. One order covers both.

Locke POLE LINE HARDWARE *and* INSULATORS

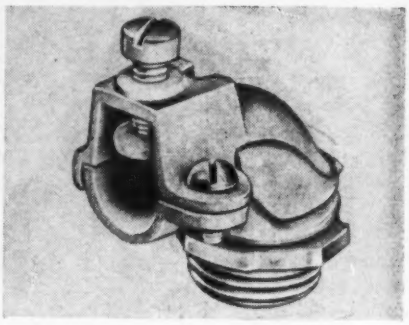
LOCKE INSULATOR CORPORATION • BALTIMORE 3, MD.

in three sizes. Case sizes in the 110-v ratings are: 20 to 160 mf, 1⅜ x 3⅛ in.; 160 to 300 mf, 2 x 3⅛ in.; 320 to 420 mf, 2 x 4⅛ in. In the 220-v rating, case sizes are: 20 to 30 mf, 1⅜ x 3⅛ in.; 30 to 60 mf, 2 x 4⅛ in. The 2-in. diameter case is furnished with screw terminals taking a 10/32 screw. The 1⅜-in. diameter case has solder lug terminals with ⅛-in. lead clearance.

•

Angle Connector

A 90-DEG ANGLE connector designed for the new 1946 Code PVX cables is

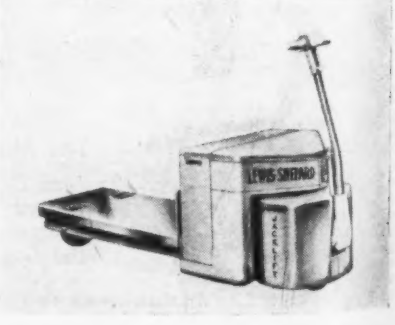


announced available by Gedney Electric Co, 1270 Sixth Ave, New York, N. Y. It is malleable iron and has a "shoe-hold" cable grip that is stated to lock tightly the cable into the connector without damaging the cable. Designated Cat. AC-15, the new connector accommodates 14-2, 14-3, 12-2 and 12-3 cables.

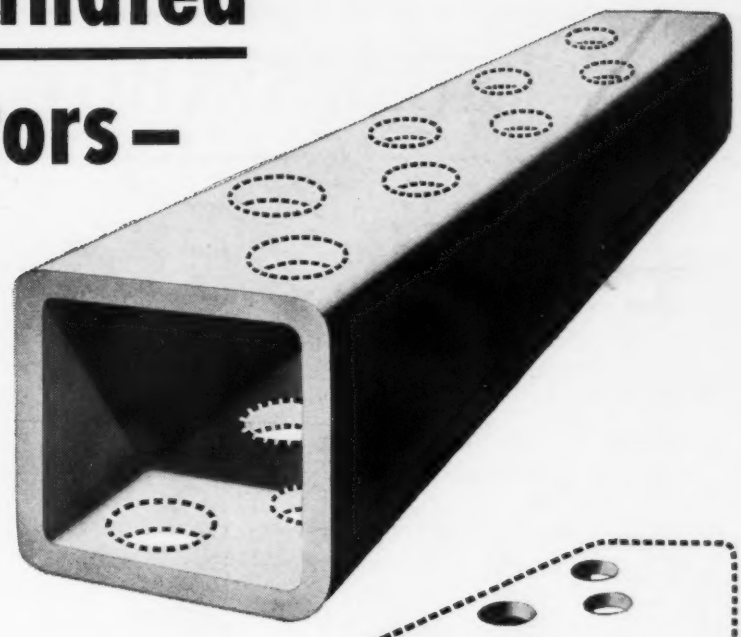
•

Hand-Operated Truck

AN ADDITION of a 6,000-lb capacity, electric platform model Power Jacklift to a line of hand-operated trucks is announced by Lewis-Shepard Products, Inc, 293 Walnut St, Watertown 72, Mass. The machine is controlled by pushbuttons in the handle head and may be operated with the handle vertical or in any other position. Vertical handle operation is reported to save up to 18 in. in aisle space. Whenever the handle is released, the "deadman" type electric braking control functions. The Jacklift has an interchangeable power unit.



In CHASE Ventilated Bus Conductors—



The Shape

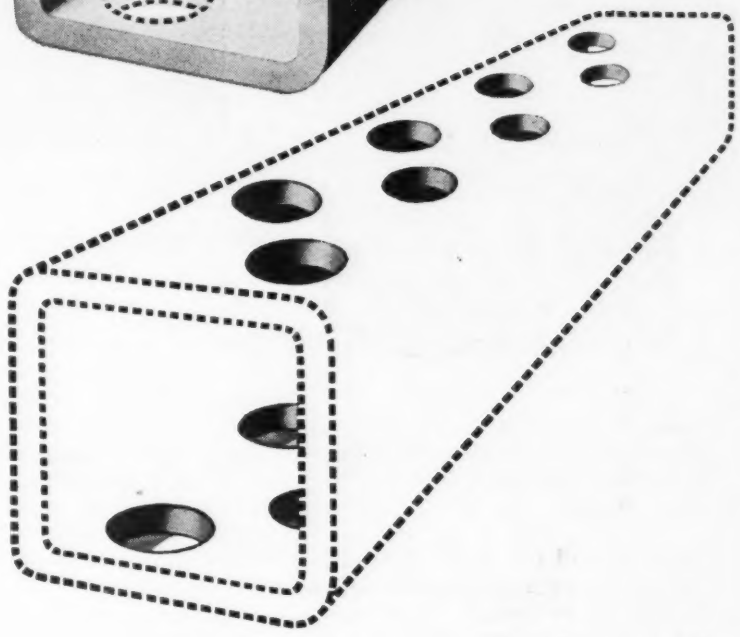
makes them stronger

Rigid, square-type tube and heavy, one-piece construction provide great mechanical strength in all directions.

The Holes

keep them cooler

Ventilating holes, in top and bottom of Chase Bus Conductors, provide internal cooling by natural convection.



EASY to install and requiring no auxiliary clamping devices, one-piece ventilated Square Copper Tube . . . first developed commercially by Chase . . . may solve your AC bus problems—as well as save you time and money. To find out more about this and other bus conductor forms, write for the Chase Electrical Handbook.

Also, include a description of your bus requirements. Chase engineers may be of time-saving help in working out your plans for new AC installations. Address Chase Brass & Copper Co., Dept. EW-87.

Chase

the Nation's Headquarters for
BRASS & COPPER

WATERBURY 91, CONNECTICUT

SUBSIDIARY OF KENNECOTT COPPER CORPORATION

THIS IS THE CHASE NETWORK . . . *handiest way to buy brass*

ALBANY† ATLANTA† BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DETROIT HOUSTON† INDIANAPOLIS KANSAS CITY, MO. LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER† SAN FRANCISCO SEATTLE ST. LOUIS WASHINGTON† (†Indicates Sales Office Only)

NEWS ABOUT PEOPLE

E. H. Will Made Manager of Operations in Virginia

E. H. Will, formerly president of the El Paso Electric Co, El Paso, Tex., has returned to his native state, Virginia, to become general manager of operations of Virginia Electric & Power Co, with headquarters in Richmond, Va.

E. H. WILL

Mr Will entered the engineering department of the Virginia Electric & Power Co in 1922. Later he was transferred to Norfolk in charge of the engineering department and subsequently was promoted to assistant superintendent of the electric department. He also occupied the position of assistant to the vice-president of Vepco and for four years from 1928 to 1932 was manager of the Suffolk district of the company. For three years he was assistant to the general manager of the electric department of which he now becomes the head.

Mr Will has been in Texas since 1935, where he was, first, superintendent of El Paso Electric Co and in recent years has been president of that company.

•

▶ DONALD V. STEGER, formerly director of industrial relations of the John B. Stetson Co, Philadelphia, has been elected executive secretary of the Western Society of Engineers. Mr Steger succeeds Leigh S. Keith, who has been secretary of the society since 1935.

H. S. PATTON

Patton Assumes New Duties With Illinois Utility

Harold S. Patton has been elected a vice-president of the Public Service Co of Northern Illinois, succeeding the late William J. MacPherson.

Mr Patton became associated with the utility in 1915 when he began work as a substation operator. Subsequently he served as power supervisor, assistant electrical engineer and manager of division operating. Four years ago he entered the industrial relations department, and for the past two years has been manager of industrial relations for the company.

•

▶ DR THOMAS H. HOGG, formerly chairman of the Ontario Hydro Electric Commission, has been sworn in as head of a commission set up by the Manitoba Government to report on hydroelectric power development in the province. He will also act as consulting engineer.

▶ W. E. KNOX, president, Westinghouse International Co and CHRISTIAN WINTHER, Westinghouse regional supervisor located in Oslo, have been awarded the Order of St. Olav First Class by King Haakon of Norway. Both orders were personally presented by Minister of Commerce Evenson.

▶ BORIS EMMET has been elected executive vice-president of the Noma Electric Corp, New York.

W. D. Kyle, Jr, Appointed Vice-President of L-M

Announcement has been made of the appointment of W. D. Kyle, Jr, as vice-president of the Line Material Co, Milwaukee, Wis. A director of the company since 1945, Mr Kyle will serve as executive assistant to his father, W. D. Kyle, L-M president.

A graduate of Cornell University, Mr Kyle, Jr, received his electrical engineering degree from Cornell University, and after obtaining his early engineering experience in the engineering department of Wisconsin Electric Power Co, he joined the Line Material Co's industrial engineering department, doing plant layout and production efficiency work and later was transferred to the research and development department.

In 1939 he became president of the Kyle Corp, manufacturers of oil circuit reclosers, sectionalizers and connectors. Under his guidance and direction, the Kyle Corp began the manufacture of high-strength connectors. For the present, he will maintain his presidential position with the Kyle Corp in addition to his executive duties at Line Material.

W. D. KYLE, JR

•

▶ DR EDWIN R. WHITEHEAD has been named director of the Department of Electrical Engineering at Illinois Institute of Technology. He replaces Dr Louis T. Rader who has joined General Electric Co. Dr Whitehead has been a half-time research professor at the

We're not Doing You a Favor!

In these days of critical shortages, some firms seem to consider it a favor to provide a needed product. But here at Ryerson you'll find no seller's market complex. Every inquiry is still regarded as an opportunity to serve and every order a compliment to our organization.

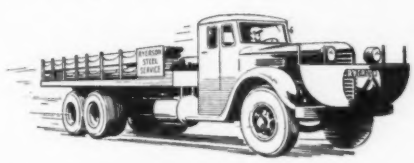
Prompt shipment of steel from stock is our business. When we can deliver needed steel, we're more than glad to do it. The thanks belong, not to us, but to you for letting us work with you.

That's the way we have done business for more than 104 years—through good times and bad, and that's the way we continue to operate.

Much as we'd like to handle every item on all your orders, present conditions often make this impossible. But stocks of alloys, stainless bars, seamless tubing, and many other products are in good supply at each of our twelve plants, and products or sizes out of stock today may be available tomorrow.

So contact your nearest Ryerson plant for prompt, personal service. We may not always have all the steel you need but we'll certainly do everything possible to take care of you.

Joseph T. Ryerson & Son, Inc. Steel-Service Plants at: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles.



RYERSON STEEL

Institute since October, 1946. He has also been consultant in electrical engineering in general charge of the a-c network calculator at the Armour Research Foundation of Illinois Tech. A graduate of the University of Colorado, he received his graduate degrees from the University of Pittsburgh. From 1932 to 1946, he was in the Engineering Department of the Duquesne Light Co. He is a fellow of the American Institute of Electrical Engineers.

•

North American Co Elects Two New Vice-Presidents

Directors of The North American Co have elected as vice-presidents Paul D. Preger, comptroller and John G. Johansen, secretary.

Mr Preger was first employed by North American in 1923. He became comptroller in 1935. Mr Johansen became identified with the company in 1924. He was made secretary in 1942.

•

▶ W. W. LYNCH, formerly vice-president of the Texas Power & Light Co, Dallas, has been made executive vice-president of the company. JOHN C. YOUNG, who has been associated with the company for 24 years, has been made a director and vice-president. Mr Young will continue his position as district manager at Waco.

▶ H. C. MCELHONE has been elected vice-president in charge of sales of the Lamb Electric Co, Kent, Ohio. Before joining this company in 1945, Mr McElhone was assistant to the vice-president in charge of sales of Westinghouse Electric Corp, with which he spent 22 years.

▶ W. W. HENLEY has been reelected president of the West Florida Electric Cooperative Association. At the same time J. M. Heisler was elected vice-president, and C. A. Cozart, secretary-treasurer.

▶ E. R. WILSON, Abbeville businessman, has been appointed by Governor Thurmond to the South Carolina Clark's Hill Power Authority to succeed Rep. Robert S. Galloway of Abbeville who recently resigned.

▶ CHARLES J. CLEMENTS, supervising engineer in the electrical engineering department of the Cleveland Electric Illuminating Co, has retired after nearly 40 years of service with the company.

Porteus Named President, of Sterling Engine Co

James B. Porteus has been elected to the board and named president of the Sterling Engine Co, Buffalo, N. Y.

Mr Porteus, who succeeds the re-

J. B. PORTEUS

signing president, Addison F. Vars, was formerly with the Westinghouse Electric International Co, in charge of distribution in Brazil and subsequently in north Latin America. Mr Vars was elected chairman of the board of directors, effective as of November 1. He is taking a leave of absence until that date.

George M. Ebert continues as executive vice-president and comptroller.

OBITUARY

▶ BOYD C. DENNISON, professor of electrical engineering at Carnegie Institute of Technology for 37 years, died on August 19 at his home in Pittsburgh, Pa. He was 66 years old. Before joining the teaching staff at Carnegie Tech, Mr Dennison was associated with the testing department of General Electric Co in Schenectady, N. Y. He was active in the American Institute of Electrical Engineers, being a past-chairman of the Pittsburgh section.

▶ JOSEPH W. COWLES, 78, long superintendent of the installations department, Boston Edison Co, died at Brookline, Mass., on August 15. He was graduated from Cornell University in 1890 and was employed on the test by the then Thomson-Houston Electric Co at Lynn, Mass., for eight months. Transferred to the Boston office, he traveled in the eastern half of the country on installation work. Joining the Boston Electric Light Co in 1895, he organized the meter and incandescent lamp department. In 1901 Boston Edison purchased the company and Mr Cowles joined the laboratory staff, becoming head of the installations department a year later. He retired in 1935. His work in the national organizations of the industry was valuable and long continued.

•

Gen J. G. Harbord

Lieut Gen James G. Harbord, USA (retired), former president and chairman of the board of the Radio Corp of America, died on August 20 after a brief illness at his home in Rye, N. Y. He was 81 years old. Because of failing health, General Harbord recently retired as chairman of the RCA board of directors (ELECTRICAL WORLD, August 9, page 28).

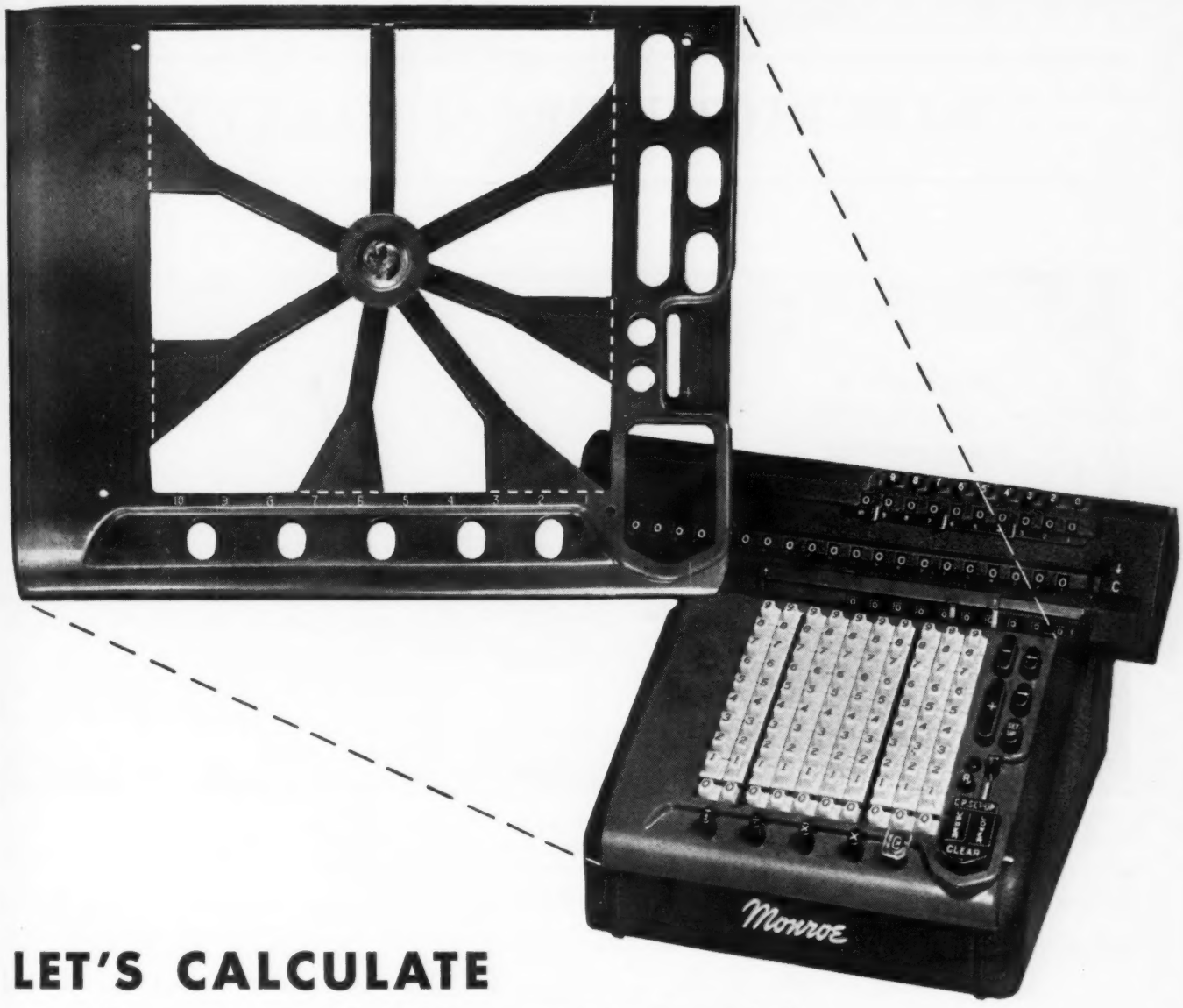
After a distinguished military career, General Harbord joined RCA on January 1, 1923, serving as president of the corporation until 1930, when he was elected chairman of the board of directors. When he applied for retirement from the Army, the Secretary of War approved it with following comment: "The industry into which you are going is still in its infancy, and offers a large field for your activity. Being a gallant leader in the Army, there is no doubt that you will prove to be an equally great leader in the industrial and commercial field."

During his association with RCA, he played a vital part in the development of radio from a communications medium into an integral part of many industries and of the national defense.

•

▶ ALFRED H. ("BERT") ALLCOTT, 59, merchandise sales manager, Central Vermont Public Service Corp, died at Rutland, Vt., August 15. Born at Providence, R. I., he occupied this position for some years with the Narragansett Electric Lighting Co. In 1927 he accepted a similar position with the Twin State Gas & Electric and Vermont Hydro-Electric companies, Boston. He was transferred to Rutland in 1932.

▶ HAROLD J. W. FAY, 71, for many years president of the Submarine Signal Co, Boston, Mass., now the marine division of Raytheon Mfg Co, died in Boston on August 14. He was born in Westboro, Mass., and in his early career was employed by the Bell Telephone Laboratories, joining Submarine Signal in 1907. Recently he was awarded the Edward Longstreth Medal of the Franklin Institute for his contributions to supersonic and electronic developments utilized effectively in the late World War.



LET'S CALCULATE what one plastic part saved in this CALCULATOR!

YOU COULD RUN UP a big total on this Monro-Matic Calculator if you figured the following savings in dollars and cents!

Through use of BAKELITE Styrene plastics *at least five steps were avoided* in the manufacture of the keyboard top-plate you see above.

Suppose this part had been stamped or drawn from another material—instead of injection-molded in one simple operation from this versatile BAKELITE plastic. First, it would have been blanked out. Then stamped. Then drawn—then pierced—then finished with primer and lacquer topcoat . . . After molding, the BAKELITE Styrene plastic part is trimmed of its gates and sprues—nothing else. Even the *color* is an integral component. And trimming follows molding so immediately that the two are considered one operation.

And in totaling up the savings, don't forget to figure in the reduced tool cost and tool maintenance resulting from the ease and simplicity of injection molding!

In these days of price and quality competition, one of your most important production questions is, "How can you do it *better*—and cut costs?" Often the answer lies in such a plastic as BAKELITE Styrene—with its excellent dimensional stability, lightness in weight, resistance to moisture, chemicals, perspiration, its ease of handling, and other valuable characteristics. Write Department **58** for Booklet G8, featuring BAKELITE Styrene and other types of plastics and resins.

BAKELITE

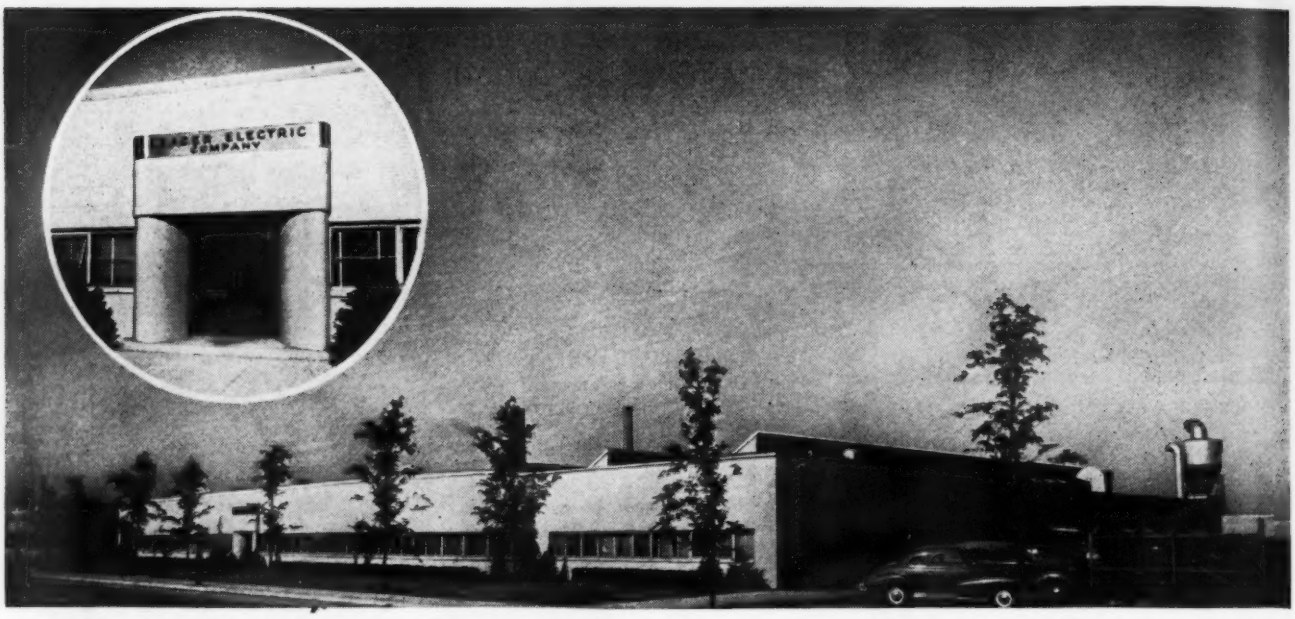
TRADE-MARK

Styrene

PLASTICS

BAKELITE CORPORATION, *Unit of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N. Y.

MANUFACTURERS & MARKETS



LEADER ELECTRIC CO is now moving factory operations and executive offices to this building at 3500 North Kedzie Ave, Chicago. With more than double the floor space at the former plant, 6127 Broadway, Chicago, the management expects a corresponding increase in production. Additional modern equipment will also be installed

Sperti, Inc, of Cincinnati Buys Faraday Electric

Sperti, Inc, Cincinnati, has acquired the Faraday Electric Corp, at Adrian, Mich., William H. Albers, chairman of the Sperti board of directors, has announced. In the future, the plant will be known as Sperti-Faraday.

Actual purchase price of the Faraday Corp was not disclosed, but reliable sources estimate the assets of that company at $1,500,000. The consolidation of Sperti and Faraday combines the research and engineering departments of both companies into one of the strongest electrical products laboratories. Both organizations control hundreds of patents and licensing arrangements in the electrical field. After preliminary adjustments, which include moving the Faraday Boston units to Adrian, the corporation will introduce a complete line of signalling devices for homes, factories, hospitals and institutions, to the electrical and building fields. At the same time, a complete line of household appliances will be available.

Heading up the new Sperti-Faraday subsidiary is Mr Albers, chairman of the board. Ralph A. Lostro, president of Sperti, Inc, is president; Lewis J. Stern, of Adrian, vice-president, general manager and director; and Eugene F. Olsen, vice-president and treasurer. Mr Stern has been general manager of Faraday for sometime. Mr. Olsen is president of Stearns Manufacturing Corp of Adrian. Rensselaer Clark of Grand Rapids, automobile body manufacturer, also will take an active part in the management of the subsidiary.

•

Nela Specialty Division Will Be Discontinued Sept. 1

The lamp department of the General Electric Co will discontinue its Nela Specialty Division, 1 Newark St, Hoboken, N. J. Its sales personnel will be transferred to other lamp department sales districts. The sale of GE glow lamps and sodium lamps, which the Nela Specialty Division has handled in the past, will be handled in the future by other lamp department sales districts throughout the country. Other miscellaneous products formerly sold by the Nela Specialty Division will be sold nationally in the future by the lamp department's Atlantic Sales District, 570 Lexington Ave, New York.

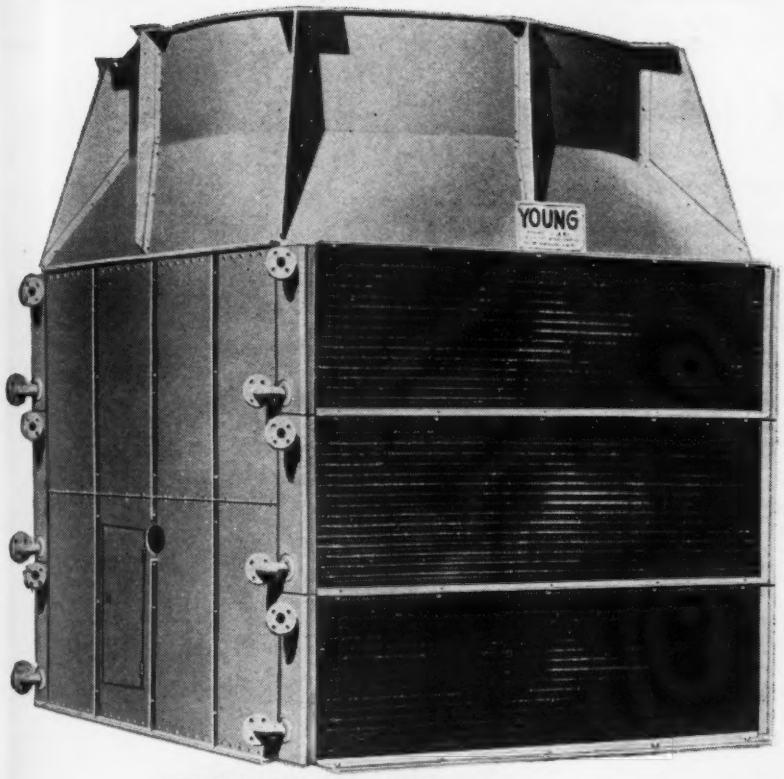
Westinghouse Orders Set New Peace-Time Record

Westinghouse Electric Corp has announced that orders received for the first six months of 1947 totaled $418,156,772. This figure is higher than the total for any entire pre-war year and compares with $384,828,548 for the last six months of 1946.

Net income at Westinghouse for the first half of this year amounted to $21,735,442, equal to $1.59 a share of the company's common stock. This represented a return of approximately 7 percent on net sales billed during the period.

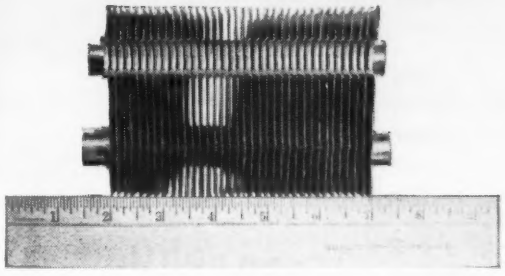
"The profit of only 7 percent on sales," Gwilym A. Price, president, reported to the board of directors, "shows that the corporation has been moderate in its price increase compared with increases in payroll and other costs. In addition, on May 1, the corporation reestablished its pre-war firm price policy to help stabilize the price situation . . ."

The company's net sales billed for the first six months of this year amounted to $312,338,636, comparing with $301,691,788 for all of 1946 and exceeded the company's total output



YOUNG VERTICAL AIR DISCHARGE COOLING UNIT

Illustrating one model in a new series of large capacity cooling and condensing radiators. Induced-draft fan is mounted horizontally in the shroud with air discharged upward. Rated capacities of the various sizes in the VAD series, when cooling from 150°F. to 140°F. with 100° air, range from 3,300,000 Btu/hr. using 25 H.P. for cooling fan to 9,000,000 Btu/hr. with 50 H.P. fan. Total air swept cooling surface of the largest unit is approximately 42,000 sq. ft.



Section of core used in the above cooling unit. Continuous-type fins are formed from copper strip.

12,800 FEET OF SEAMLESS COPPER TUBE

FOR EFFICIENT COOLING OF WATER, OIL OR GAS

NEARLY 2½ miles of Anaconda Seamless Copper Tube go into the giant Vertical Air Discharge Cooling Unit manufactured by Young Radiator Company, Racine, Wisconsin. Tubes are ⅝″ O.D. x .035″ wall thickness.

The uniformly high quality of Anaconda Deoxidized Copper Tubes is an important factor in the construction of very large heat exchange equipment. For units like this, down to small space heaters and automobile radiators, manufacturers select copper for its high thermal conductivity, corrosion resistance, durability and ease of working. Where unusual corrosion resistance or extra strength is required, The American Brass Company offers a wide choice of the highest quality corrosion-resistant metals in the form of sheets, rods and tubes for heat exchange equipment.

Call on our Technical Department for assistance in selecting the most suitable alloys for your requirements. 4779

ANACONDA
from mine to consumer

Anaconda

COPPER & COPPER ALLOYS

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD.
New Toronto, Ont.

Where and How to Use *Crapo* Steel Conductor

Ask for This Guide to Low-Cost Rural Lines!

If future plans call for the extension of rural service, be sure to ask for a copy of this Manual! A study of its contents will show where and how *Crapo* Steel Conductors can be used to profitable advantage in rural distribution systems.

This illustrated book contains pertinent data on the electrical characteristics and electrical performance of these unique conductors. It shows how construction costs can be reduced by the use of long spans, gives initial and final sag and tension data, describes construction practices, cites typical installations.

***Crapo* Steel Conductors are especially applicable to rural taps and branches where construction and maintenance costs are important considerations. The experience of a number of leading utilities over a period of years shows conclusively that *Crapo* Steel Conductors are giving dependable, economical and efficient service on thousands of miles of line in rural areas.**

***Crapo* Steel Conductors are distributed by Graybar Electric Company, Inc. Ask a Graybar representative for a copy of the *Crapo* Steel Conductor Manual or write direct for Manual No. 110-C.**

Indiana Steel & Wire Company
Muncie, Indiana

***Crapo* Steel Conductors**

for any peace-time year prior to 1941.

Unfilled orders as of June 30, 1947, totaled $673,496,915, compared with $449,633,226 a year ago.

•

Announce Price Increases on Electrical Appliances

A limited increase in the prices of some products, has been announced by Frigidaire Division, General Motors Corp. P. M. Bratten, general sales manager, pointed out that these increases reflect advancing costs in materials and losses caused by irregular production due to material shortages.

Frigidaire appliances affected by the price adjustment include electric refrigerators, showing an increase of $5 to $15, with no increase on three models; electric ranges from $5 to $10, with no increase on two models; and the automatic electric washer, which has been increased by $15. There is no increase in the prices of Frigidaire home freezers, electric dryers and ironers. Commercial refrigeration and air-conditioning product prices have been adjusted upward, on an average, by approximately 2 1-3 per cent.

Philco Corp has announced retail price rises of about 8 percent on its lower-priced refrigerator models. Philco has twelve models in its complete line of home refrigerators. The price adjustments affect only the four lowest priced models.

Prices on all shipments of washers have been raised about $10 per washer, Bendix Home Appliances, Inc, has announced. Recommended list price to distributors is now $239.50 for the standard model and $259.50 for the de luxe model, installed in each case. The price also includes a year's warranty and a washing demonstration.

•

Eureka Division Opens New Export Department

The Eureka division of the Eureka Williams Corp has opened an export department designed to operate on a world-wide basis, George T. Stevens, executive vice-president and manager, has announced. Opening of the new export department represents in part Eureka's post-war plan for widening its activities, Mr Stevens stated. He pointed out that the Eureka division has completed removal of its executive offices and factory equipment from Detroit, Mich., to Bloomington, Ill., where a $1,000,000 program for plant expansion has been effected.

The department will function under the direction of Henry A. Dineger, export manager, who recently returned

ELECTRONIC EQUIPMENT BARGAINS

JOBBERS
WHOLESALERS
MANUFACTURERS

Large inventories of valuable electronic tubes, devices and equipment are being offered by the WAA Approved Distributors listed herewith for your convenience. Alert commercial buyers are taking advantage of this big bargain opportunity. Why not fill *your* present and future requirements from these available stocks. Act now—while inventories still permit wide selection.

Purchase of this surplus equipment has been greatly simplified. The Approved Distributors appointed by WAA were selected on a basis of their technical background and their ability to serve you intelligently and efficiently. Write, phone or visit your nearest Approved Distributor for information concerning inventories, prices and delivery arrangements. You'll find you can "Save with Surplus."

BOSTON, MASS.
Automatic Radio Mfg. Co., Inc
122 Brookline Ave.
Technical Apparatus Co.
165 Washington St.

BUCHANAN, MICH.
Electro-Voice, Inc.
Carroll & Cecil Sts.

CANTON, MASS.
Tobe Deutschmann Corp.
863 Washington St.

CHICAGO, ILL.
American Condenser Co.
4410 N. Ravenswood Ave.
Belmont Radio Corp.
3633 S. Racine Ave.

EMPORIUM, PENNA.
Sylvania Electric Products, Inc.

FORT WAYNE, IND.
Essex Wire Corp.
1601 Wall St.

HOUSTON, TEXAS
Navigation Instrument Co., Inc.
P. O. Box 7001, Heights Station

LOS ANGELES, CALIF.
Cole Instrument Co.
1320 S. Grand Ave.
Hoffman Radio Corp.
3761 S. Hill St.

NEWARK, N. J.
National Union Radio Corp.
57 State St.
Standard Arcturus Corp.
99 Sussex Ave.
Tung-Sol Lamp Works, Inc.
95—8th Ave.

NEW ORLEANS, LA.
Southern Electronic Co.
512 St. Charles St.

NEW YORK, N. Y.
Carr Industries, Inc.
1269 Atlantic Ave., B'klyn.
Electronic Corp. of America
353 W. 48th St.
Emerson Radio & Phonograph Corp.
76—9th Ave.
General Electronics, Inc.
1819 Broadway
Hammarlund Mfg. Co., Inc.
460 W. 34th St.
Johanns & Keegan Co., Inc.
62 Pearl St.
Newark Electric Co., Inc.
242 W. 55th St.
Smith-Meeker Engineering Co.
125 Barclay St.

NORFOLK, VA.
Radio Parts Distributing Co.
128 W. Olney Road

ROCHESTER, N. Y.
W. & H. Aviation Corp.
Municipal Airport

SALEM, MASS.
Hytron Radio & Electronics Corp.
76 LaFayette St.

SCHENECTADY, N. Y.
General Electric Co.
Bldg. 267, 1 River Road

WASECA, MINN.
E. F. Johnson Co.
206 2nd Ave., S. W.

OFFICE OF AIRCRAFT AND ELECTRONICS DISPOSAL

1284

WAR ASSETS ADMINISTRATION

GOVERNMENT WAA SURPLUS

Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cincinnati • Cleveland Dallas • Denver • Detroit • Fort Worth • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock Los Angeles • Louisville • Minneapolis • Nashville • New Orleans • New York • Omaha • Philadelphia Portland, Ore. • Richmond • St. Louis • Salt Lake City • San Antonio • San Francisco • Seattle • Spokane • Tulsa

T.J. Cope INC.

QUICK COUPLING CONDUIT RODS

STRONG
EFFICIENT
SIMPLE & SURE LOCKING
LONG LIFE — LOW COST

Rodding conduits with Cope Equipment is the positive way. Engineered to the work, these rods lock securely—disengaging in the duct is an impossibility. Sticks of seasoned straight grained, second growth hickory, are well sanded and oil toughened insuring ease of handling and long life. The couplings, of best grade, annealed, malleable iron are power driven on the sticks and securely riveted. Made in 3′ and 4′ lengths with a straight shaft of 1″ diameter. Cope Quick Coupling Conduit Rods will give years of dependable service.

For light weight, we offer Cope Aluminum Coupling Conduit Rods and Screw Coupling Conduit Rods, each a quality product for your needs.

FLEXIBLE CABLE FEEDER

LIGHT OR HEAVY CABLE FED WITH MINIMUM EFFORT

To facilitate the damage-free feeding of cable from the street reel into the conduit, Cope offers this flexible Cable Feeder. With a funnel-like mouth for easy application of pulling compound, the heavy 4″ galvanized, flexible steel tubing has at the conduit end a steel sleeve which will accommodate various size brass nozzles to fit different sizes of conduits. For cable feeding, this Cope equipment assures complete protection.

It pays to specify Cope.
Write for our complete catalog.

T.J. Cope INC.
6120 Vine Street,
Philadelphia 39, Pa.

TOOLS AND EQUIPMENT FOR THE INSTALLATION AND MAINTENANCE OF CABLE FOR OVER FIFTY YEARS

from an extensive exploratory trip to Europe. Headquarters will be in the Empire State Building, New York.

•

Manufacturers Make Sales Assignments

Electrical manufacturing companies have recently made the following appointments to their sales staffs:

Edwin F. Guth Co, St. Louis, Mo., has appointed Oscar Hogenson representative in northern Idaho, Oregon and Washington, with offices at 95 Connecticut St, Seattle 4, Wash. Mr Hogenson has been actively associated with lighting since 1918, having had practical experience at the contracting, wholesaling and manufacturing levels.

Ward Leonard Electric Co, Mount Vernon, N. Y., has appointed the Durling Electric Co, 2002 St. Paul St, Baltimore 18, Md, as representative in Virginia, south central Pennsylvania, Maryland, except for the Washington area, and Delaware south of Wilmington.

Elliott Co, Jeannette, Pa., announces two new district managers. J. M. Maag is now Kansas City district manager. Mr Maag was a field engineer in the Elliott Chicago office from 1925 until 1941, when he became St. Louis district manager. H. W. Honefenger, who joined the company in 1936 as field engineer of the St. Louis office, has now been appointed St. Louis district manager succeeding Mr Maag.

Ransome Machinery Co, a subsidiary of Worthington Pump & Machinery Corp, Harrison, N. J., has appointed Allan B. Kime eastern regional manager in charge of the sale of Ransome positioning and turning roll equipment. Mr Kime has had extensive experience in the electrical manufacturing field, having been associated with the Federal Shipbuilding & Drydock Co, Kearny, N. J.; the Century Electric Co and the Lincoln Electric Co.

The Eastern Specialty Co, Philadelphia, Pa., has appointed Frank L. Frable of 122 South Michigan Ave, Chicago 3, Ill., representative in the states of Illinois, Indiana, the northern penisula in the state of Michigan, the eastern part of the state of Wisconsin and the eastern part of the state of Iowa.

•

Moves Detroit Offices

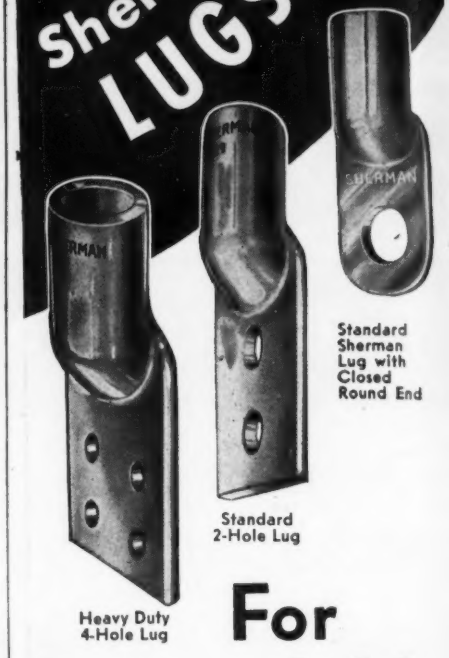
Emerson Electric Mfg. Co., St. Louis, Mo., has announced that its new quarters in Detroit, Mich., are located at 1375 East Jefferson Ave.

•

Westinghouse Seeking Gas

To guard against another possible fuel shortage next winter, Westinghouse Electric Corp is drilling for gas on the grounds of its copper mill in East Pittsburgh.

Sherman LUGS



Standard Sherman Lug with Closed Round End
Standard 2-Hole Lug
Heavy Duty 4-Hole Lug

For Dependable Soldered Connections

Sherman Soldering Lugs are clean, bright, and free from grease, inside and out. To prepare them for soldering, Sherman Lugs are tumbled in sawdust, given a special acid cleaning bath (bright finish) and then rigidly inspected. You get a perfect solder joint every time when you use these lugs. That's why it pays to specify Sherman!

Also:

Solderless Lugs • Splicing Sleeves • Split Bolt Connectors • Wedge Grip Connectors • Ground Clamps and Fittings • Armor Rod Clamps • Jumper Clamps

H. B. SHERMAN MFG. CO.
Battle Creek, Michigan

WRITE FOR Sherman CATALOG!

LETTERS TO THE EDITOR

Floor Heating in Korea*

To the Editor of ELECTRICAL WORLD:

I have just read with great interest an article, "Panel Heating Installed in Concrete Floors," in the 14th September, 1946, issue of ELECTRICAL WORLD. (Thanks to Red Cross I was able to get three issues).

Inasmuch as the house I now live in has an electric floor I thought you and some readers may be interested in knowing how the Japanese did it.*

The Koreans were very much pleased to look at your publication. Even if they did not read and understand English, they did understand the pictures and circuit diagrams. (Several are now studying English.)

One of my jobs is American Manager of Seoul Electric Co, Ltd, Inchon Branch, Inchon (Jensen) Korea, and I should appreciate it if you could send me a complete copy of "Organization Distribution Staff Duties Summarized" on the essential duties of officials of a public utility distribution department so I may give it to the company and they may see the American setup.

Any additional articles you may see fit to send, concerning electric companies, would be greatly appreciated.

Emmett A. Parrish
Major, Air Corps

Silicone Insulation

To the Editor of ELECTRICAL WORLD:

In the July 5 issue of ELECTRICAL WORLD, page 93, I'm reported to have supplemented the H. P. Walker paper on Silicone Insulation as applied to Naval Electrical Power Equipment with a discussion of a 3-kva transformer with Silicone insulation and magnesium case as weighing only 45 pounds. The weight reduction is greater.

At that summer AIEE meeting in Montreal I mentioned 3-kva, 25-kva and 150-kva designs that have already been made. The 3- and the 25-kva units are of 450-117-volt ratings and the 150-kva unit applies to a resistance furnace transformer of 450 to 30/16-volt rating. The two smaller units were designed with pressed steel and also with magnesium cases. The 3-kva unit with the magnesium case weighs only 39 lb and not 45 lb as quoted. This makes a weight saving of 44 percent over existing class B Navy Specifica-

* See article, page 76, this issue.

for INSULATION RESISTANCE Measurements

Vibrotest IS BEST

36 Models for every application

Ranges up to 50,000 megohms

SIMPLE PUSH BUTTON OPERATION

For every insulation resistance measurement the versatile Vibrotest is far superior in its field. Ruggedly constructed throughout; large, easy to read meter scale; stable self-contained power source; fully guarded—no erroneous readings due to surface leakage even in extremely humid conditions.

Ranges available up to 50,000 megohms at 500 VDC or 1000 VDC potential, with ohmmeter ranges covering a wide range. Most models include three convenient ranges of A.C. and D.C. volts.

Write for Bulletin 208

ASSOCIATED RESEARCH, Incorporated
"Precision instruments since 1936"
221-C SOUTH GREEN STREET • CHICAGO 7, ILLINOIS

Flexible!

CONTROLLED FLEXIBILITY is just one of the advantages of FLEXO WIRE AND CABLE

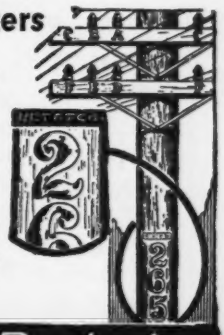
FLEXO is designed to serve hundreds of versatile needs and to solve many of your problems for heavy duty, long wearing wire and cable.

FLEXO can supply you with any type of uninsulated wire and cable to meet your exact requirements.

WRITE TODAY
Ask for Catalog 58-H

FLEXO WIRE COMPANY
70 WEST FIRST ST. — OSWEGO, NEW YORK

Easy To Identify Premax Markers



There'll be no mistaken identities if poles and lines are marked with Premax Metal Markers. Clear and legible at all times. Send for details.

Premax Products
Division Chisholm-Ryder Co., inc.
4606 Highland Ave. Niagara Falls, N. Y.

Subox
ANTI-CORROSIVE PAINT
SubaLox
LEAD & ALUMINUM PAINT
Simplify Maintenance
Give Maximum Protection
Subox, Inc.
NORTH ARLINGTON, N. J.

tions or a 57.5 percent weight saving over class A insulation used a decade ago.

A reduction of 65 percent results in the cubic inch content as compared with units built ten years ago. You have correctly stated that these units do have considerable overload capacity. Also, the development work described is a step in the direction of building dry type transformers for low voltage distribution circuits. Overload capacity can be provided without adding additional kva in transformer ratings. The primary goal in designing these units was to reduce the transformer weight and volume and to lessen maintenance problems.

M. L. Manning
Chief Engineer
Kuhlman Electric Co
Bay City, Mich.

Television Rates

To the Editor of ELECTRICAL WORLD:

Your editorial in the July 19 issue of ELECTRICAL WORLD, which has just been brought to my attention, seems to call for some further explanation from us as to why we adopted the video rider in our new residential rate schedule. You quote an editorial from *Electronics* magazine, whose objection to our Television Rider was based on "a disputed set of facts"—and you then add that you oppose our television program for a different reason, namely that you see it "as a false obstruction to the sale of kilowatthours.".

I would say that the position taken by ELECTRICAL WORLD is also debatable and for two very good reasons. First, I doubt if anyone contemplating the purchase of a television set would rate the obvious dollars and cents entertainment value accruing to him from television broadcasts at only $1.26 per month. Secondly, television sets, because they are without significant diversity, add very little compensation in the way of kwhr per kw of system demand responsibility. We estimate that an average set (with supplemental lighting) will add less than 400 revenue kwhr per year.

While I would not expect the Editor of *Electronics* to be familiar with the methods of cost analyses as applied to public utility systems, I must admit that your apparent lack of knowledge of the fundamental economics of utility operations took me by surprise. Moreover, you may deem it your "privilege" to criticize our management for not wishing to sell kilowatthours at a loss, but I doubt if you would be supported in this stand by the large majority of ELECTRICAL WORLD readers. Especially is this true in view of the fact that you have not, to my knowledge, examined the demonstrable facts and justification motivating our policy, although an invitation to do so was extended to you by both ourselves and our consultants.

While our utility industry may extend the aforementioned editorial "privilege," we question your right in assuming the "privilege" of telling our customers what actions they should take in protest against decisions by management which may fail to meet with your approval.

The accompanying tabulation is taken from the report submitted by our consultants and summarizes very clearly the costs and revenues for video only, with and without supplemental lighting.

Very truly yours,
Theodore Braaten
General Manager
Gas and Electrical Dept
City of Norwich, Conn.

An editorial commenting on this letter will be found on page 40. Editor.

	COSTS AND REVENUES—VIDEO ONLY		
	Annual Cost To Serve @ 8% Return*	Annual Revenue With Rider	Annual Revenue No Rider
ADDING VIDEO WITH SUPPLEMENTAL LIGHTING TO:			
1. Lighting—includes minor appliances 2. Lighting and Refrigeration	$33.52	$26.71	$11.59
3. Lighting, Refrigeration and Range 4. Ltg, Rfr, Rng, & Uncontrolled Water Heat	18.62	20.09	4.97
5. Ltg, Rfr, & Uncontrolled Water Heat 6. Ltg, Rfr, & Controlled Water Heating 7. Ltg, Rfr, Rng, & Controlled Water Heating	33.52	20.09	4.97
ADDING VIDEO *WITHOUT* SUPPLEMENTAL LIGHTING TO:			
1. Lighting—includes minor appliances 2. Lighting and Refrigeration	16.38	20.78	5.66
3. Lighting, Refrigeration and Range 4. Ltg, Rfr, Rng, & Uncontrolled Water Heat	16.38	17.56	2.44
5. Ltg, Rfr, & Uncontrolled Water Heating 6. Ltg, Rfr, & Controlled Water Heating 7. Ltg, Rfr, Rng, & Controlled Water Heating	16.38	17.56	2.44

* This 8% return for a municipal operation paying no taxes of any kind is equivalent to about 3% return for a privately owned utility subject to present tax liabilities.

As shown in the second section of the foregoing tabulation, the television rider (in amount $15.12 per year) does not, nor was it intended to, recover the cost liabilities of the supplemental lighting.

BOOK REVIEWS

National Electrical Code Handbook. By A. L. Abbott. Published by McGraw-Hill Book Co., New York. 633 pages, illustrated. Price $4.

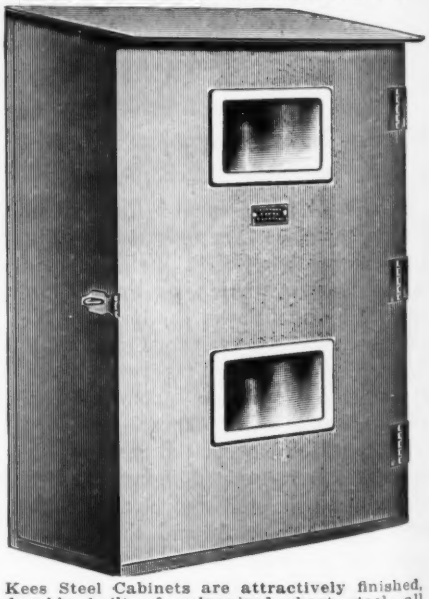
The new 1947 edition discusses in detail the rules in the new 1947 Code. In doing this the author has not hesitated to rearrange and rephrase the wording if so doing would make their intent and import clearer. As usual the illustrations are a great help in this direction.

The Management Leader's Manual. By J. O. Rice and M. J. Doober. Published by American Management Association. 190 pages. Price $3.

Twenty authorities contributed this compilation of ruling principles drawn from management literature so that operating executives, supervisors and foremen alike may have access to psychological guidance. Any of them at any level cannot fail to be self-critical as he studies the terse precepts and examples here set forth in systematic presentation. Major themes are democracy in leadership and in work teams, the supervisor's managerial responsibilities, signs of supervision inadequacy, principles of disciplining, conduct of interviews and "dissatisfaction" sessions, the supervisor's role in accident prevention, and work simplification. Near the end is a quiz entitled "What's Your Management I.Q.?"

This first of a series of handbooks has spiral binding and flexible covers for the frequent use an appreciative user is certain to give it, as much in service industries like power companies as in production establishments.

KEES *Weatherproof* STEEL CABINETS



Kees Steel Cabinets are attractively finished, durably built of galvanized sheet steel—all joints electrically welded—with baked aluminum finish. Easy and economical to wire and mount. Supplied with or without windows—knock-outs-meter panels. For wall, pole or cross arm mounting.

FREE Send for Kees Free Catalog of boxes for meters and instrument transformers, outlet box hangers, hold card holders, conduit straps, etc.

F. D. KEES MFG. CO.
Established 1874
Box 647 Beatrice, Nebraska